THE

ELECTRICAL REVIEW.

VOL. LXIII. DECEMBER 11, 1908. No. 1,620.

ELECTRICAL REVIEW

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ELECTRICAL FATALITIES IN COLLIERIES.

ON several occasions we have drawn attention to the serious inefficiency of persons in charge of electrical installations at collieries, and to the disgraceful and negligent way in which many of these plants are installed and attended to. We may, in fact, claim to have been the first to draw attention to the increasing number of colliery accidents, in spite of the "Special Rules," and to suggest the appointment of electrical mining inspectors to see that the special rules regulating the use of electricity in mines are properly carried out and adhered to; and it is gratifying to see that at least one such appointment has been made, though until there is a radical change in the *personnel* responsible for the safe and proper working of the mine and the machinery in connection with it, no amount of inspection will improve matters to any extent.

In our issue of the 27th ult. we briefly reported a fatal accident which occurred at Dark Lane Colliery belonging to the Mirfield Coal Co., of Ravensthorpe, Yorkshire, the victim being Allan Wilcock, who was killed by receiving a shock from a "pull wire" which controlled a sluice valve regulating the flow of water and small coal in connection with a coal-washing machine—which is electrically-driven—the wire having come in contact with an electric conductor, thus making the pull wire "alive." We may remark that this is not the first time a fatal accident has occurred from exactly the same cause. At the inquest the usual inefficiency of the staff was prominent, and, in addition, the almost impossible task of H.M. Inspectors properly inspecting the mines and plant was also elucidated, as Mr. Pickering (H.M. Chief Inspector for the district), in reply to a juror who asked why he had not inspected the electrical apparatus at the colliery, said that "it was impossible for him to do so," seeing that there were 400 mines and 800 quarries in the district, and that he and a colleague were the only inspectors. Mr. R. Nelson, the newly-appointed Electrical Inspector of Mines, attended the inquiry as representing the Home Office, but if Mr. Nelson is to be the only Inspector for the whole of the collieries in the British Islands, we venture to predict that his time will be occupied mainly in attending inquests, instead of visiting collieries for the purpose of making examinations, pointing out defects in the installations, generally advising those in charge who are in doubt, and warning transgressors.

The impossibility, however, of such a course is evident, as the above state of things more or less applies to every district, and even if a separate electrical inspector were attached to each district, it would scarcely be possible for him to inspect each individual colliery once a year. With regard to the *personnel* of the above-named colliery, we learn that the "electrician" (?)

"never interfered with the wires except on orders from Mr. Wanless, the colliery engineer," and that "he had not made reports of the examinations, though it was now the rule that such should be done." The engineer did not tell him specifically to examine the wires but to "look round." In turn, the engineer threw the responsibility of examining the electrical apparatus on the electrician "except to a small extent"—whatever that may mean. "It was the man's duty to see that all electric wires were properly insulated and to repair any that were out of order." The colliery manager, strange to say, does not appear to have been blamed. The following verdict was returned:—"The jury are unanimously of opinion that Wilcock died from electric shock. . . . They are further of the opinion that there has been a lack of systematic inspection of the wiring, and a neglect of the special rule which provides that all electric circuits must be completely insulated from earth, tested daily, and a record kept of such tests. They are also of the opinion that it is a case of *inexperience rather than negligence*."

The italics are ours, and this simple, plain statement of the jury backs up our contention that it is time "inexperience" gave way to "experience," and that properly qualified engineers trained to the work were appointed in place of Tom, Dick, or Harry with just sufficient smattering of electricity to prove the truth of the old saw "A little learning is a dangerous thing," as coalowners are finding out to their cost.

It is, however, really difficult to see how the law can be amended. The owners would, no doubt, welcome the change, but they are in the hands of the colliery managers, who, backed up as they are by the Home Office, may object to a reduction of their responsibility if this would also mean a reduction of salary and—for want of a better word—what we may term "swagger." That mechanical and electrical engineers are a necessity is evident from their employment by the larger colliery companies, and they, in many cases, act directly under the agent or managing director, to whom they are solely responsible. Why, then, not invest the chief mechanical engineer with that authority which would make him absolutely responsible? Such a course would strengthen his position, and add to his dignity, while the owners and the country generally would reap the benefit. We should then hear less of these sad accidents which are already only too common. As the introduction of electrical machinery will go on increasing year by year, unless something of the kind we suggest is done to remedy matters, we are greatly afraid—in spite of special rules and electrical inspectors—that there is not much chance of the number of such accidents lessening.

There is one thing, however, which, we venture to suggest, might be done as a step towards what we believe is what every colliery engineer in the country would gladly welcome, and that is, for all mechanical and electrical engineers to form themselves into an "Association of Colliery Engineers," similar to the "Colliery Managers' Association," for their mutual benefit and protection, and quietly but firmly to agitate for their rights. As there must be many amongst our readers interested in this question, we will gladly throw our columns open to them so that they may state their views upon what we believe to be a most important and pressing question.

The First Tramway Brakes Report.

Owing to a misapprehension of certain of the statements made in a letter published in the pages of our contemporary, the *Tramway and Railway World*, it has become necessary that we should return to the subject of the report of the Tramways and Light Railways Association on brakes.

There is no doubt, as we said, that the Tramways and Light Railways Association did in the early stages of the then proposed report suggest to the Municipal Tramways Association a Joint Committee with a view to the preparation of one report. This the Municipal Tramways Association refused to agree to, and both societies started over two years ago on the work of preparation for a report. When recently the report of the Tramways and Light Railways Association was completed, and that of the Municipal Tramways Association was printed in draft, a suggestion was made that the two reports should be printed together, and that the two Committees should meet with a view to drawing up one series of conclusions and recommendations. The report of the Tramways and Light Railways Association having, however, been completed and printed ready for publication, it was very late in the day to propose that the two bodies, or two Committees from the two bodies, should be asked to undertake what would be practically a reconsideration or reprinting of their previous work. We expressed the view last week that the Board of Trade officials would have been much better able to prepare regulations with a single report before them than with two. But we are reminded that neither of the Associations, nor the two Associations combined, could be expected to prepare more than the materials on which the Board of Trade regulations could be founded—they could not be expected to draw up the regulations themselves, and the Board of Trade officers may really be considered to have before them, in the opinions of both the Committees, as much information as they require, even though at the time of the recent meeting with Col. Yorke only the first report was in its final form. The Tramways and Light Railways Association has never shown any wish other than that which it displayed when it, in the beginning, suggested to the Municipal Association that the report should be the work of a Joint Committee. There seems to have been a misunderstanding as to the Committees amalgamating in their work after they had proceeded through some stages, and it does not appear that the Tramways and Light Railways Association was ever under the impression that any joint action of the Committees of the two Associations was expected after the work of preparing the report had actually begun.

We were, we regret to find, in error with regard to the resignations mentioned in our last issue; of the signatories to the Tramways and Light Railways Association report, only Mr. Fell resigned, he having become president of the Municipal Tramways Association. We are also informed that no reply has been sent by Mr. Hamilton to the letter of the Hon. Arthur Stanley. Not only was the report of the Tramways and Light Railways Association completed before the recent meeting with the Board of Trade, but the whole edition, a large number, was already printed and ready for publication. The report of the Municipal Tramways Association was not ready, but at the request of the latter Association the publication of the report of the former was held over for a week or more.

The report of the Tramways and Light Railways Association is signed by the members of the Committee, which included tramway managers, tramway engineers, consulting engineers concerned in tramway matters, and others independently interested only in a general way. The Committee of the Municipal Tramways Association consisted entirely of tramway managers, and it is not surprising that the two reports are not quite of the same complexion or general character.

We may therefore, after all, conclude that, although it was rather difficult to understand the seeming differences between the two Associations, these differences do not affect the *bona fides* of either Association, nor do they affect our opinion concerning the reports as expressed in our issue of the 20th ult.

The Second Brakes Report.

The Committee appointed by the Municipal Tramways Association to consider the question of brakes for tramcars has now issued its report. Under the circumstances it is inevitable that a comparison should be made between the two reports which are before the public, but we are glad to say that in making that comparison, neither party will suffer. Both reports are admirable, and give evidence on every page of an absence of bias, an amount of technical knowledge, a minute

acquaintance with working conditions, and an easy literary style, which we should expect to find as a result of the collaboration of the constituent members of each Committee.

While we would not be without the technical introduction to the Tramways and Light Railways Association Report, which might well become the standard text-book on the theory of braking, we surmise that the Municipal Tramways Association Report will be the more popular because it has taken the theory for granted, and preaches direct from the text of practice, with the consequence that the quantity of reading to be done is much reduced, and that is a matter of some moment where the people chiefly concerned are busy men and laymen.

The Report reached us so late in the week that we are unable to give it more than a few lines in this issue, but next week we shall print it in abstract form, and shall refer to its salient features. It is dated October 12th, and is signed by Messrs. J. Aldworth, J. M. McElroy, J. B. Hamilton, Peter Fisher, Henry Mozley, Chris. J. Spencer, and A. R. Fearnley (hon. sec.)

Whereas the Tramways and Light Railways Report expressed the opinion that separate brakes should be used for coasting and for service or emergency, the Municipal Tramways Association Committee would prefer to see one brake perform every function, but it realises that at present it is necessary to fit two distinct brakes to every car.

While the Tramways and Light Railways Association Committee lays much stress on the sanding gear, the Municipal Tramways Association Committee feels that the safety of passengers should not depend on this, and recommends that the rails on gradients be kept clean by the use of serrated cast-iron track-brake shoes, which will obviate the necessity for sand.

The practical result of the Committee's deliberations is that a brake which can be applied instantaneously to both rails and wheels either by hand or power from a single lever, with the least possible chance of skidding the wheels, and with provision for operating it from the conductor's platform, is the most desirable, and the Committee agrees with Col. Yorke that an independent brake for purely emergency purposes is undesirable.

It is particularly interesting to note that the "practical" Committee, as we may venture to call the Municipal Tramways Association reporters, in contradistinction to the more theoretically minded committee of the Tramways and Light Railways Association, recommends cast-iron track-brake blocks, while the latter committee holds the opinion that cast-iron is inferior to wood. It is a pity that such divergences of opinion should have been allowed to see the light, for they are bound to mislead and confuse the public, which looked to the chief authorities of the tramway world for single-minded utterances and sure guidance. The executive of the Municipal Tramway Association ends its prefatory note to the report with the remark that the Association has decided, with Col. Yorke's approval, to pursue its investigations with a view to clearing up certain points of divergence in the two reports and to arrive, if possible, at some general conclusions which may be valuable to the B. of T. in framing future regulations.

Cheap House Wiring.

Considerable correspondence has taken place recently in the pages not only of our English contemporaries, but also of some of the American technical journals, on the subject of flexible cord wiring. Surface wiring by means of flexible cord is said to be a common practice on the Continent and in America; but if we correctly interpret the views of the American Board of Underwriters and of the general body of American Electrical Contractors, we gather that they are not at all friendly disposed towards the flexible cord system. A great deal has, in fact, been written against the use of flexible, particularly in shop windows. There can be no doubt, that, for such lighting, the flexible cord introduces a very undesirable risk.

A flexible looks an innocent thing. It is so convenient, too. It can be twisted round metal brackets and fixtures so as to permit of the light being hung in any desired position, and it lends itself so readily to decorative effect that the young ladies who dress the millinery windows would sadly miss it for pinning little things to if its use were to be prohibited. Just fancy an electrician sticking a pin through a live flexible! Yet the Girl from Kay's, bless her, does it without a tremor. The wonder is there are not more fires, and we have much to be thankful for in that there is a special providence which watches over the foolish.

It is not for shop window lighting particularly, but for surface wiring generally that there appears to have arisen a craze for the flexible cord. When a "short" does occur in a flexible, it probably does not greatly matter whether the applied voltage is 230 or 100; in either case the insulation is liable to take fire. But we imagine that on the voltages ranging from 200 to 250 with one pole earthed, as is the common practice in this country, there is far more risk than on 100 to 110-volt circuits, in which both conductors are insulated from earth, as in American and Continental practice.

The desire for a cheap class of wiring seems to come from supply station engineers rather than from the contractors, and it is said to be due to a falling revenue brought about by the increasing use of the metallic-filament lamp. If this be so, it is important that we should not risk a decided and permanent lowering of the standard of installation work, in order to tide us over a temporary critical period in the supply business. Those who value reputation, play the long game; and we must consider the future of the industry as well as the present in discussing any drastic change in the methods of British installation work, the standard of which is justly considered to be second to none.

In saying this, we must not be understood to condemn any attempt to cheapen installation work; we are only anxious that whatever modifications are introduced should not lower the standard of safety. To put it on no higher ground, we cannot afford to have fires caused by electricity, with such a keen competitor and rival as gas in the field, ready to take advantage of the least alarm on the part of the public. There are many places in America where electricity has no competitor but the kerosene lamp, and this naturally tends to slackness and a low-grade of wiring work. Perhaps we ought to be thankful that the rivalry of gas has kept us up to concert pitch.

As to the use of flexible cord, whilst we do not agree that the Institution Rules definitely approve of flexible cord wiring, we see little objection to its use on ceilings—apart from aesthetic considerations.

A multiple contact ceiling rose with several flexibles radiating from it to insulating hooks, from which the pendants hang, is not an uncommon practice for the lighting of billiard tables. Such an arrangement can be made to look quite sightly, and is practically as safe as if the wires had been laid in casing or tubing. But the switch wires, or other wires laid on the surfaces of walls, need some kind of protection.

Some years ago a method of wiring in flexible metallic tubing was proposed. This is now slowly coming into use for motor wiring on machinery, and we know that some consulting engineers always specify it for the finishing lengths between the steel conduits and the motor terminal box. There are, it seems to us, possibilities in this method for surface wiring in small properties. A good quality of flexible inside a small flexible metallic tube would lend itself to quick work, and this metallic protection need only be used on walls, say, up to the cornice, where a multiple connection box would be fixed, from which the flexibles would start. Being metallic, the tube would need earthing. Perhaps, if there were a demand for it, a flexible fibre or papier maché tube could be made on the same lines as the flexible metallic tube, and such would be as safe as wood casing, and much more easily and cheaply erected.

D

THE USE OF ELECTRICITY IN TESTING AUTOMOBILES.

By Dr. ALFRED GRADENWITZ.

An interesting dynamometer plant, which allows the various factors determining the efficiency of automobiles to be ascertained immediately, has been constructed by Dr. Schuyler S. Wheeler, vice-president of the American Automobile Club, and is now being used by the latter.

This plant allows the travelling speed (in miles per hour, and in feet per second), the pull of the draw-bar, horse-power at the periphery of the driving wheels, the climbing capacity, and the working of the brake, to be ascertained at a moment's notice, and as it is the first of its kind, a short account of it may be of interest.

The speed being determined independently of any tests on the road, no police authorisation for exceeding the admissible speed limits need be obtained, while any danger of accidents due to tests of this kind is eliminated. In order to get rid of the noxious exhaust gases from the automobile motor, the testing floor is provided with efficient fans.

As will be seen in the figures, the track is made to rotate round an axle, the automobile being kept in position by means of cables, The track consists of two big drums, protruding through slots in the floor (fig. 1), which are set rotating by the driving wheels of the car. The rotation of the drums is counteracted by a large pendulum, suspended below the floor, which is attached to the drum shaft through an adjustable device, designed on the Alden absorption-dynamometer principle.

Instead of determining the torque according to the usual method, it is used to deflect from its vertical position a pendulum 560 lb. in weight (which, by the addition of auxiliary weights, can be increased to 1,600 lb.). The shaft carrying the pendulum is fixed at its right-hand end to the housing of the Alden dynamometer, and on the left of the pendulum are arranged two dash pots, which absorb any oscillation of the shaft and pointer indicating the pull. The scale of pulls extends over an angle of 30°, readings being taken according to divisions of 30 lb. each, in either direction (that is to say, for forward or backward travelling), up to 1,600 lb. As the torque measured by the deflection of the pendulum, the scale immediately gives the pull at the draw bar. Close to the large pendulum is arranged a small pendulum, parallel to the former, which serves to actuate electrical contacts by the aid of which a motor-driven slide is displaced, in a horizontal direction, across the large efficiency chart (fig. 1), thus causing a vertical ruler to assume a position corresponding to the draw-bar pull. Two carriages are provided, for forward and backward travelling, respectively.

The far more difficult task of accurately measuring the speed of travelling is solved by means of a horizontal ruler, moving in a vertical direction across the large chart, without absorbing any part of the available energy of the automobile, or impairing the accuracy of the tests just mentioned.

The apparatus used in this connection comprises a lengthy cone, kept rotating at a constant speed of 200 r.p.m. by a shunt motor, and actuating a bell that rings at each 100 revolutions, or at intervals of 30 seconds. This cone is provided with a large centrifugal-governor, diverting part of the shunt current of the driving motor, with decreasing speeds, through shunt-connected resistances, while opening these shunt circuits in the case of increasing speeds. This arrangement allows the speed to be maintained constant to within ½ per cent. A small wheel, in light contact with the surface of the cone, is arranged so as to rotate freely on a cylinder, mounted on a resilient shaft parallel to the face of the cone, and driven through gears from the large drums above mentioned. This cylinder carries two contacts, between which there moves an arm fixed to the small wheel with convenient contact points. If the peripheral speed of the cone

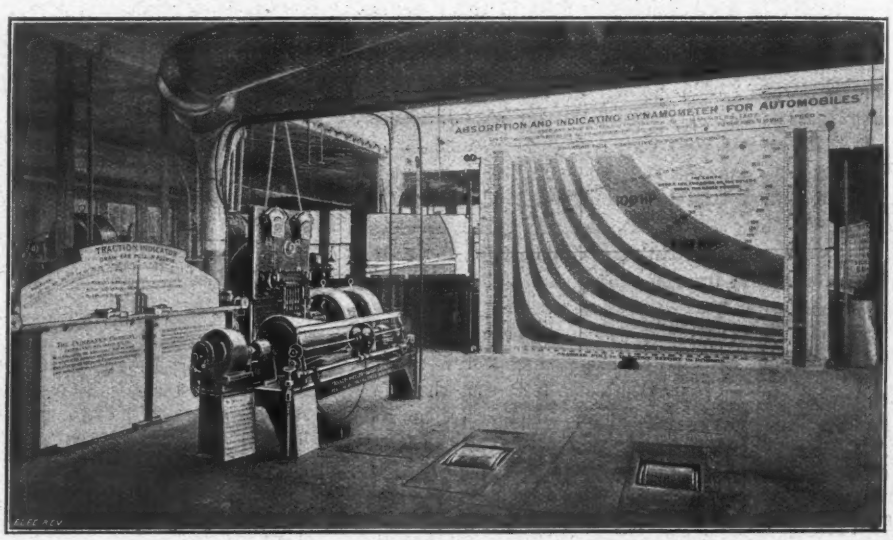


Fig. 1.—General View of Apparatus in Test-room.

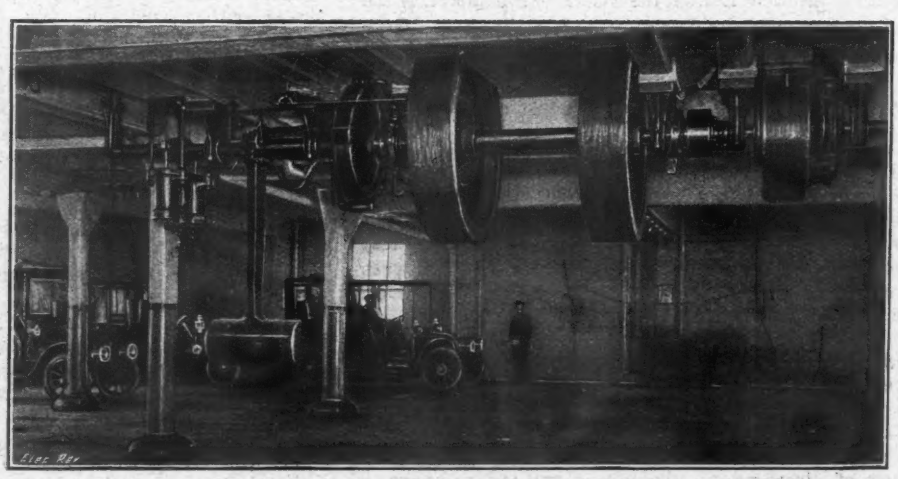


Fig. 2.—View in Basement, showing Shaft, Drums, Dynamometer and Dash-pots.

at the point where the small wheel touches it be such as to impart to the wheel a speed differing from that of the cylinder and its shaft, it will cause the small arm carried by the wheel to come into contact with one or other of the cylinder contacts, when the cylinder and wheel (by means of a special motor fed through the contacts) will be moved along the shaft. The speed of the wheel will thus be varied until it equals that of the cylinder, when the displacement of the latter being discontinued, the horizontal ruler is arrested at the corresponding point of the efficiency chart.

This process of speed measuring, being based on a single attachment, which rotates at a constant and adjustable speed, allows of a remarkable accuracy. The wheel in the case of automobile speeds of, say, 60 miles per hour, should be shifted close to the large end of the cone, in order to rotate along with the latter, while in the case of such low speeds as 5 miles per hour it should be moved towards the small end.

The efficiency chart is drawn to a scale sufficient to allow readings to be effected from a considerable distance, and contains 79 curves, showing immediately the horse-power from 8 to 300, which has beeen calculated according to the well-known formula—

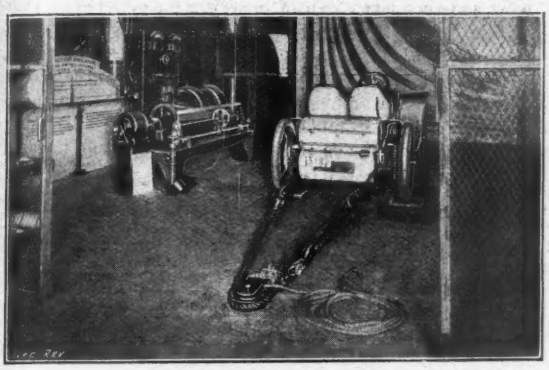


Fig. 3.—Car under Test.

$$\text{Horse-power} = \frac{\text{pull (pounds)} \times \text{speed (M.P.H.)}}{375}.$$

This chart thus dispenses with any calculation. It also contains a number of scales, giving the speed of the car either in ft. per minute, or in miles or kilometres per hour, or else in minutes per mile or kilometre.

All these measuring instruments are reversible, and allow the car to be tested in both forward and backward running.

Another interesting apparatus is the grade meter, fixed to the left of the main chart (figs. 1 and 8), and which is actuated by the pendulum gauge of the dynamometer. This apparatus comprises a pointer, pivoted round one of its ends, while its other end traverses two parallel arcs, showing the gradient the car is able to ascend with the actual draw-bar pull. The latter is shown by a short pointer, travelling over a scale on the right-hand edge of the board, while a sliding clamp on the grade-indicating pointer is set to the figure corresponding to the weight of the car. The grade motor has been constructed according to the following formulæ—

$$\text{Sine of angle or grade} = \frac{\text{tractive effort}}{\text{weight of car}}.$$

$$\text{Grade in per cent.} = \frac{100 \times \text{pull}}{([\text{wt.}]^2 - [\text{pull}]^2)^{\frac{1}{2}}}.$$

The maximum gradient negotiated by the wheels without slipping is about 35 per cent.

In order to examine the behaviour of the automobile in coasting down hill, either forward or backward, all that is required is to start an electro-motor driving the shaft of the two large drums on which the driving wheels of the automobile rest, when the brakes can be tested, and the wheels carrying the automobile motors can be actuated freely, the automobile yielding no power, while the relative friction losses in the transmission and wheel bearings of the automobile can be ascertained.

The first car to be examined with this dynamometer was the 90-H.P. Mercédès car of Mr. William K. Vanderbilt, jun. Though the motor of this car apparently reached its full speed, developing nearly the whole of its indicated output, the output recorded at the high speed of 74 miles at the rear rims was only 30 H.P. This paradox is difficult to account for, and may be due to the car having developed only part of its power at the speed in question. In the case of the lower speed of 21 miles per hour, an output of 50 H.P. and a pull of 880 lb. was obtained.

In testing a 30-H.P. car, a maximum speed of 15 miles per hour was obtained with a tractive effort of 510 lb. at the draw bar, the rear wheels showing an output of 30 H.P. The ratio of the pull to the weight (and the maximum grade negotiated at the speed in question) was 20 per cent. With the second speed, the car at 25 miles per hour developed 22 H.P. at the rear wheels, with a pull of 340 lb., while in the case of the third speed (with which direct operation was used) 36 miles were covered per hour, the pull being 270 lb., and the output 25 H.P. at the back wheels. The combined efficiency of the motor and transmission was found to be 83·4 per cent., provided that the motor developed the indicated output of 30 H.P. In downhill coasting, when the transmission shaft and motor were set rotating by the rear wheels, 38 H.P. was absorbed, thus showing the possibility of using the motor as a brake in travelling downhill.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Storage in Electricity Works.

In Mr. Lackie's most interesting and valuable inaugural address, he is reported to have said that the "good" storage battery has not arrived as yet. Now, Sir, though we are all pining for the "ideal" storage battery, yet surely that need not debar us from using the batteries that are on the market if there is anything to be gained thereby.

Mr. Lackie speaks of the figure of £80 per KW. of maximum demand, of which, no doubt, his steam plant and transmission and conversion plant (to his city sub-stations) would account for some £40 to £50. Is he aware that a battery big enough to take 7,000 KW. off the top of his peak could be got for some £5 per KW. (ex. auxiliaries)?

No doubt he will reply that I have forgotten the fogs. In reply to that, I would say that a battery for a continuous 5-hour discharge could be got for some £10, which would leave 3½ hours of additional peak available to deal with fogs.

If Mr. Lackie can show that his worst fog-load adds an area above the 14,000-KW. line of his published diagram, integrating more than 24,500 KW.-hours (7,000 × 3·5), I will then admit that Glasgow is an unfortunate (though not impossible) city in which to use batteries for lighting. But in that case I would still contend that it would pay him to put them in for power.

Assuming, for example, that his summer curve, as published, is practically all "power," the above £10 battery would take up 2,500 KW. off his engine and boilers, and enable the stand-by losses of boilers corresponding with this output to be saved by shutting down boilers to this extent for the whole year. Mr. Lackie himself supplies the data for arriving at the annual coal saving, which is, roughly, 400 tons per boiler shut down.

He would really be able to shut down some additional boilers above those needed for the 2,500 KW., because he would have, at all times of the summer, a battery stand-by equal to a one-hour discharge at some 7,000 KW. during the first hour of the fog, when boilers could be started up if thought desirable. So that really it might be possible to shut down boilers and engines all the year round (or nearly all)

to the extent of something like 5,000 KW., with corresponding saving in coal, wages and repairs.

The fog might last for the whole 12 hours of the day, but this would not affect the batteries, as the motor load taken up by them only integrates up to some five hours, and the remainder of the evening peak would be carried in the usual way with the steam plant.

If some 10 per cent. (including interest, sinking fund, maintenance, and depreciation) on the capital cost of steam plant, and some 17½ per cent. on that of accumulator plant, are the relative annual expenses, exclusive of all savings on fixed charges introduced by the cells, and if the capital costs are in the ratio of 3 to 1 or 4 to 1, surely there is a case for accumulators, even in their present stage of development. But, as a matter of fact, it can be shown that the savings in fixed charges will alone much more than pay for the perpetual maintenance of the cells; so that the only question outstanding is not the existence of, but the amount of, the saving in interest on capital.

A. M. Taylor.

King's Heath, *December 4th*, 1908.

Branches v. Agencies.

I am not prepared to discuss my personal relations with my firm, as they have no bearing on the commercial point at issue, but I can assure "Vilex" that I get all the information I want.

A branch is not necessary for the handling of such inquiries as "Vilex" mentions, and he must know it.

If a branch manager stocks what he fancies, and not what he can sell, then he is not fit for his position, and a branch manager that is foolish because he pleases to be "within limits," is beyond the scope of my imagination.

There is no such thing as the over production of commercial engineers, the real difficulty is the scarcity of them, and of men who will adopt the peculiar training necessary.

The game of "Follow my leader" I am not concerned with, but I do say that a branch run by a man who can understand and work out the technical needs of his clients, in a thoroughly commercial and practical manner, is going to win all along the line, if properly backed.

As to "Vilex's" remarks about "Branches," "Waiting," and "The British Public," I can only state that facetiousness is not argument.

The fact that "Vilex" happens to be more successful as an agent than as a branch manager, points to one of two conclusions, viz., either "Vilex" did not, or was not allowed to, run his branch as vigorously as his agencies, or else his agencies are for different classes of manufactures.

I realise what perhaps "Vilex" does not, that given a certain personal factor, all things are possible, but when granting the correctness of his figures in his own particular case, I think it is unreasonable of him to think and argue that his conclusions must be the only correct ones, to be applied universally.

This matter of "Branches *v.* Agencies" is a really important question, and is not settled or even properly discussed by dragging in questions of personal earning power.

Argument in fortnightly instalments has its sweetness too long drawn out for me. Does "Vilex" care to collaborate and issue a joint article as a conclusion to the matter, so far as two individual business men are concerned?

London Manager.

Electrical Driving in Cotton Mills.

Replying to the letter of "G. L." in your issue of December 4th, I do not think I need say much concerning the first portion. The three estimates I gave were simultaneous estimates, and the prices were those at which good work could have been obtained during the busy time. Prices all round may now be lower, and "G. L." should, therefore, put before us a similar set of estimates by first-rate makers all round. Take the one item of ropes, my figures for ropes might be cut down to half probably, if, say, Kenyon Bros. would *condescend* to quote for $10 Caunts Surat yarn ropes, and so on with other items.

Coal bill.—I will answer this by asking "G. L." to present figures from similar mills with superheat, rope and electrically driven. My figures do not necessarily imply what he reads into them. Is "G. L." so very sure that he can drive 100,000 spindles with the same coal as required by a rope drive?

Then how does he lay claim to the exclusive use of the turbine for electrical work? I could easily apply the turbine to a rope drive by suitably modifying the rope drums, the shaft speeds, and the driving and driven-belt pulleys. Really he cannot monopolise the turbine. But is he sure that every turbine has proved itself in cotton mill work? Curious rumours were floating about my native valley a few months ago.

As regards the £560 in *re* the lighting; this is a matter of opinion. Separate sets are used by the best people. Otherwise the difference in the two estimates is simple. One is rope driven off the mill shafting, the other is more expensively driven by a motor or a separate engine.

"G. L." must not, therefore, prepare a one-sided estimate on present slump prices. His figures and arguments lose all their value by this. Let him get full estimates of equal class on *both* sides at present prices.

Now, as to the latter half of his criticism, it is herein that, by overstating things, he does harm instead of good.

1. Flexibility!!! Oh, that blessed word Mesopotamia!! The term Flexible has been very properly applied to the powers of electricity in the shipyard with scattered tools and to the portable tools now so much used in machine shops, but it has no meaning in the cotton spinning mill. Here in fig. 1

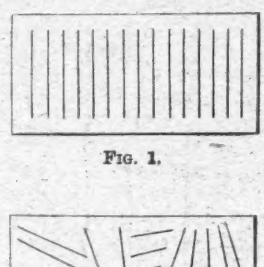


Fig. 1.

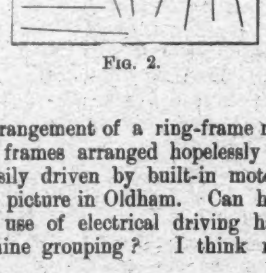


Fig. 2.

is the usual arrangement of a ring-frame room. Here in fig. 2 are ring frames arranged hopelessly for mechanical driving, but easily driven by built-in motors. "G. L." should offer this picture in Oldham. Can he point to any mill where the use of electrical driving has changed the customary machine grouping? I think not, even with separate motors.

2. Flexibility in running. Equally fallacious! Does "G. L." propose to run cards and stop the speed frames? Does he know what a young person is, within the meaning of the Act? Has he yet met a Factory Inspector on the warpath, or does he know what happens about overtime?

3. This has no existence as between mills of equal age, and "G. L." must know it.

4. We would all like to abolish the rope race, but I think "G. L." makes a little too much of the building stresses, and he certainly overrates the floor area question.

5. The rope race need not necessarily come in the body of the mill. That it does so is perhaps evidence that the rope race is not felt to be so serious an obstacle as "G. L." tries to show.

6. This is liable to be exaggerated.

In the card room the cards still have belts even with separate motor drives, and light is of less account to carding than to spinning.

The belts of speed frames and of ring frames obstruct but little light, for they are edge on to the light and they are at the middle of the frame and do not shut light out of the alley ways; often the belts are even at the middle of the room. What, then, of light? Shafts are all too high to obstruct any light; ropes do not exist where they can

obstruct light; ring frames, if driven by rim bands, have then no belts, and the ropes are negligible as regards light.

I have nothing to say as to old mills, for I have long realised that the comparisons, of which so much is made, are made with old mills and are, therefore, quite useless for modern work.

But even here "G. L." exaggerates the conditions. Are there any really old geared mills still at work? Our own place, which started in 1834, may be cited as a dead sample. It had six floors. A 26-ft. spur wheel drove two shafts on the bottom floor, or No. 1, and one shaft on the third floor. In No. 2 room there was no shafting and no visible belting. In No. 4 room there were only two 10-ft. lengths of vertical shaft which transmitted power from the third room line shaft to the fifth and sixth mule rooms. Thus, there were a few pairs of bevel wheels. No belts were visible in the fourth room. There was not a single really awkward drive in the mill.

I have already sufficiently replied to the last paragraph, except as to price of energy. If Mr. Snell is right, then pity the poor ratepayer. And if transformers are paid for by the supplier of current, the price of transformed energy will be higher than my figure. Why does "G. L." cut down my estimate of capital and refuse to debit the system with the cost of transformation? I suppose if he shoved every cost on to the poor seller of current, he would think it proved his case for electrical driving.

"G. L." should really throw aside these old mill comparisons. If there are still old mills to mend, they will not find much business very long. It is the new mills we want to get hold of, and it is in such directions as Brown, Boveri have indicated that we must seek our inducements, and not in arguments which won't bear light.

And whatever we do, let us not talk *flexible* in regard to the arrangements of the machines in a spinning mill, because a spinning mill is *sui generis* among textile works, and not to be compared with a calico printing works, or a bleach works wherein there is some room for arguments based on flexibility. Cotton spinners read the "Review," and will simply laugh at the idea of arranging their machinery on a flexible basis. How other than in parallel lines can a hundred similar machines be arranged in a rectangular building?

I might add, what seems not to be known to "G. L.," that the rope race does not reduce the space available for other plant. When men start out to build a mill they begin with a basic idea of so many spindles, and they get out their plans accordingly for that number. Not that number, less so many that are cut out by the rope race. And except that the race costs money, as I have set down against the rope drive, there are few mills where it makes any difference in the land occupied. Almost always the land unoccupied is in excess by many times the area of the race. Now, if "G. L." wishes to push the interests of electrical driving, he should endeavour to do so by enlisting electricity in its own best endeavours. Simply replacing rope pulleys by motors is a very poor matter indeed. Why do this when it costs much more initially, and the double transformation is as costly as the rope loss?

And why cut out 8 per cent. of the spindles of a ring frame in order to place a motor on the floor at the frame end, instead of properly building it into the frame and so saving end space.

100 spindles × 100 per cent. output = 10,000
92 „ × 105 „ „ = 9,660.

Where is the benefit from the increase of individual spindle output? This matter of increased output per spindle requires to be considered on fresh lines so as to be electrically justified, as, for example, by Brown, Boveri. Let "G. L." ask himself if he cannot abolish the two tin rollers and the hundreds of spindle bands by putting a little motor to each individual spindle. An electrical expert tells me he thinks this might be done. As a tin roller is 10 in. diameter, there is at once saved nearly two-thirds the breadth of the frame. In plans of a spinning room, before me, there are four ring frames to each 22 ft. bay. The abolition of the tin rollers would enable six frames to be placed in the same space, thus adding 50 per cent. to the output of a unit of floor area. Such is one direction in which electricity may yet justify itself beyond cavil, increasing output and abolishing the nuisance of soft yarns, which results from slack bands. Now that I have given "G.L." a really profitable problem to think out, I will leave him to the reflection that perhaps, after all, those of us who see the misdirected enthusiasm for electrical methods are better friends of electricity than he thinks.

At present the general unthinking advocate for change sees no deeper into the question than do rival advocates for leather or canvas belting.

W. H. Booth.

London, S.W., *December 7th*, 1908.

A Narrow Escape from Death.

On Sunday. last, whilst examining a dead 10,000-volt overhead transmission line, I was surprised, on climbing a 38-ft. pole, to find a snail on one of the wires at a distance of 3 ft. from the insulator.—Queries:—

1. How long did it take the snail to get to its position?
2. How near death was it, when moving from the cross-arm to the wire, considering that the line was dead for one night?

Lineman.

Appointments Vacant.

I send the two following advertisements taken from the London *Daily Telegraph* which, so far as I am aware, have not appeared in the technical Press, and I think some readers of the REVIEW may, perhaps, be interested to learn how the Borough Polytechnic encourages men with technical knowledge:—

Assistant-Engineer-Stoker used to hot water, gas and electric light plant, and general repairs. Must be capable of doing wiring. Commencing salary 30s. per week. Apply, with copies of testimonials, &c., Electrical Department, Borough Polytechnic, Borough Road, S.E.

Head Stoker-Electrician used to high-speed engines and able to do all repairs. Salary 40s per week. Apply, with copies of testimonials, &c., Electrical Department, Borough Polytechnic, Borough Road, S.E.

It is, perhaps, not very surprising on reading the first advertisement to find that the amiable gentlemen, who apparently have the economical working of the institution so near at heart, generously offer this stoker, with the superfluity of prefixes, who has the great good fortune to be selected for the post, a wage which is certainly no more than that paid to the majority of merely "ordinary" stokers in most London power stations.

It seems rather a pity to me that the authorities responsible do not make it an essential condition that the candidates appointed must have obtained science degrees or at least "extra chief's tickets."

As to what is to be understood by the term "head stoker-electrician," I can only guess that the individual required must be a sort of second cousin to that somewhat recent creation of the Admiralty, the "stoker-mechanic," and if so (I speak from personal experience of one of these nondescripts in a central station), I may say, in conclusion, that I would as soon trust any engine repairs, more complicated than replacing a sight-feed glass, to the care of, say, a hairdresser's assistant.

R. H. Fenwick.

Ilkley, *December 5th*, 1908.

Combined Track-Circuit and Cab-Signalling.

Will you kindly allow me a little space in which to reply to Col. Gardiner's letter in your issue of the 4th inst., pending the objections Capt. Gardiner may have to make to the article in your issue of Nov. 13th at a later date? May I also ask you to be good enough to give this letter the heading of the article? The subject under discussion is not electrical signalling in general, but the combination of track-circuit and cab-signalling put forward in Capt. Gardiner's paper.

Col. Gardiner considers that some credit should have been given the author of the paper for knowing that automatic apparatus can only perform such functions as its design permits. This claim opens the very wide question of how

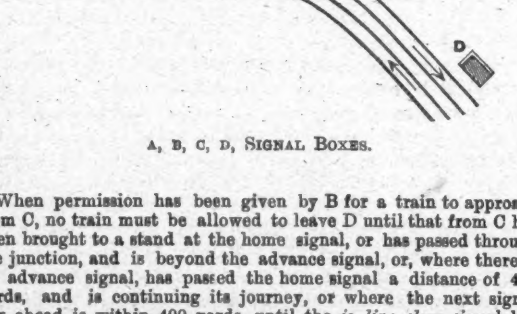
far a critic is justified in straying from the path marked out by the author. I do not wish to go into this interminable question, but will content myself for the present by saying that the paper illustrated a method of working by the simplest possible case, and contained no reference whatever to the more important requirements alluded to in the article in your issue of Nov. 13th. Ordinarily, in such proposals, one looks for recognition of the difficulties to be met by variations from the normal, and for the means by which they are to be met.

Col. Gardiner appears to think that the quotation from the paper, given in the article, has not been properly read, and desires to emphasise the limitation "as far as indicating the condition of the line is concerned." Col. Gardiner also gives his own explanation, which is that "manual control of the mechanism by which the track itself is made to indicate its condition (clear or blocked) is not only superfluous but undesirable."

So! I do not in the least object to this explanation.

It is obvious that Col. Gardiner does not recognise that the signalling *in the rear* which is all that the track-circuit, as illustrated in the paper can do, is not always all that is required. The signalling at even the simplest junction requires that when a train is approaching, from whatever direction, the lines converging or fouling that train must be blocked, and the regulations prescribe that, when passengers are being carried, no train must *be approaching* that junction on a line that will foul the train which has been given the right of way. I give below a diagram of a simple two-way junction, together with the regulations governing the acceptance of trains to fouling points. Remembering that the regulation requiring that no train must be approaching a fouling point when permission has been given for a train to occupy it, necessitates, with either automatic or manual signalling, the stoppage of fouling trains in the second section behind, I shall be interested to know in what way Capt. Gardiner's system will deal with the conditions, assuming that manual control of the mechanism by which the track itself is made to indicate its condition is superfluous and undesirable.

(*f*) *At junctions*, except where otherwise provided, the approach of trains, which can cross or foul each other is regulated as shown below:—



A, B, C, D, Signal Boxes.

When permission has been given by B for a train to approach from C, no train must be allowed to leave D until that from C has been brought to a stand at the home signal, or has passed through the junction, and is beyond the advance signal, or, where there is no advance signal, has passed the home signal a distance of 400 yards, and is continuing its journey, or where the next signal box ahead is within 400 yards, until the *is line clear* signal has been accepted by the signalman at that box, except as provided for in clause (*c*) of this Regulation; nor, in such a case must a train be allowed to leave A for D unless the junction facing points at B are set for C, and the line towards C is clear to the advance signal or where there is no advance signal, is clear for a distance of 400 yards beyond the junction points, or where the next signal box ahead is within 400 yards, until the *is line clear* signal has been accepted by the signalman at that box, except as provided for in clause (*c*) of this Regulation.

(*g*) When permission has been given by B for a train to approach from D, no train must be allowed to leave C until that from D has been brought to a stand at the home signal, or has passed through the junction and is beyond the advance signal, or where there is no advance signal, has passed the home signal a distance of 400 yards, and is continuing its journey, or where the next signal box ahead is within 400 yards, until the *is line clear* signal has been accepted by the signalman at that box, except as provided for in clause (*c*) of this Regulation.

(*h*) When permission has been given by B for a train to approach from A for D, no train must be allowed to leave C until that from A has been brought to a stand at the home signal, or has passed clear of the junction, or the junction facing points have been set for C, and the line towards C is clear to the advance signal; or where there is no advance signal is clear for a distance of 400 yards beyond the junction points, or where the next signal box ahead is within 400 yards, until the *is line clear* signal has been accepted by the signalman at that box, except as provided for in clause (*c*) of this Regulation.

(*i*) When a train has been sent to the advance or starting signal and the rear of the train is well clear of the junction, permission for a following train to approach may be given by the signalman to the signal box in the rear if the points are set for the following train to pass on to another line, and that line is clear, and the instructions given in the preceding paragraphs can be complied with.

(*j*) In dealing with trains, neither of which convey passengers, in clear weather and under ordinary circumstances, when approaching a junction on sections which converge to a fouling point, either by running into one line or by crossing each other to different lines, the mode of signalling given in Regulation 5 must be adopted, except that if the block indicator be in its normal position when the *is line clear* signal is offered for a second train, the junction signalman must, after accepting that signal by giving the *section clear but station or junction blocked* signal, and after *that* signal has been acknowledged, peg the indicator to *train on line*. On the train entering the section, the *train entering section* signal must be given in the usual way.

Capt. Gardiner's track circuit differs in no way, in principle, from the track circuit used for the operation of semaphore or other outdoor signals, and all such systems require manual control whenever a deviation from the simple line shown in the paper has to be made. In this respect it may be remarked that the references in the article to junction working and other cases requiring manual control were prompted not only by the operative difficulties, but by the fact that the multiplicity of such points renders the number at which purely automatic signalling can be carried out insignificant. If Col. Gardiner will look at a railway map of England, the importance of junction working will be forcibly impressed upon him; and if, in addition, he will remember that practically every road-side station is a point at which some deviation from straight running, involving the fouling of both lines, takes place at some time, the necessity for manual control of the mechanism by which the track itself is made to indicate its condition, will become apparent.

Col. Gardiner will hardly contend, I think, that the simple loop line arrangements shown by the model meet all the cases to be found in railway working. Apart from the operative difficulties already alluded to, there are questions raised by the selective signals contained in the code; and other functions of the signalman, which are shown by the emergency signals, are entirely ignored by a system of signalling in which manual control of the mechanism, by which the track itself is made to indicate its condition, is superfluous and undesirable.

Again, Col. Gardiner asks whether the delay due to a failure of the cab-signalling equipment of an engine will be greater than the delay due to the failure of a semaphore. I do not think that anyone with knowledge of railway working would have any doubt on the question, but I am afraid to enlarge upon it at present, considering the length of this letter already.

May I say a few words more on the question of "scrapping" (I use the term in its industrial sense). Col. Gardiner seems to look upon displacement of such apparatus with a light heart, as something in the very nature of things as they are. My remarks on the matter were intended to point out that such apparatus when displaced would not cease to constitute an item of cost to the companies concerned. Before scrapping plant, its owners have generally to be assured that they will secure something thereby that they would otherwise lose; in short, it must "be worth their while" to do so, or there is no object in it. What are the advantages that railway companies will reap from the introduction of a system of signalling in which manual control of the mechanism by which the track itself is made to indicate its condition, is both superfluous and undesirable, when the system in question, carried out as described, can only deal with a tithe of the points where signalling is required? What is the main object of signalling? Is it not the intimation to drivers of trains that points where obstructions may exist to their progress, are either clear for them to proceed, or not clear? What advantage, therefore, is there in signalling at other points, where obstructions do not exist, such as continuous signalling involves? Will the system put forward increase the safety of railway travelling which, of course, is

the first object: will it enable the companies to carry out their transport work more quickly, and thus enable them to deal with more traffic (if they can get it); or, on the other hand, will it enable them to deal with their present traffic at less cost? If any such advantages will be obtained, by all means let us have further particulars than have yet been made public.

Finally, permit me to say that I have no prejudice against either cab-signalling or the track circuit, but I am strongly of the opinion that it is folly to shut our eyes to the limitations of each, or of a combination such as is under consideration. I believe that cab-signalling has a great future before it, and I know of no journal that has more consistently advocated the provision of additional means of this kind, to enable drivers to know what is expected from them, than the Electrical Review. But cab-signalling will have a better chance of adoption in proportion as it makes a small demand on the resources of railway companies. If a large outlay, such as is involved by the displacement of the present apparatus is necessary, it is extremely probable that the companies will *hesitate* to incur the expense. And they may quite legitimately point with pride to their achievements and the progress they have made within the last generation; progress which has not resulted from outside pressure, but from their own recognition of their responsibilities. It is quite incorrect to think that railway progress has been the result of the Government spur. A consideration of the dates when railway companies installed the present system of signalling, and the date when that system was made compulsory, will show that the companies led. A certain amount of risk must always be faced by travellers, or by those engaged in any kind of work. There are disasters at sea; accidents to tramcars and motor-cars; disasters in mines, and hazard everywhere. But it must not be forgotten, however, that the danger to the railway traveller, as shown by the results achieved, is less than that undergone when any other form of transport is used, and this comparative immunity is due to the sacrifices of the railway companies and the excellent service of those of their servants who are engaged in the actual movement of the traffic. I say again: "Give men all the help possible to check their liability to error, or to know what is required of them, and leave them to do the rest." Cab-signalling is rapidly making its way, but its place is that of an adjunct to the present system.

The Writer of the Article.

Which is the Rational Method of Stoking?

This question can be answered either from the point of view of practice or of theory. From the latter standpoint, I should define the "rational method of stoking" to be "that method which, with a given weight of fuel in a given boiler, can produce the greatest total evaporation in the shortest time." This is the ideal which boiler engineers (including machine stoker makers) are constantly striving to attain. Practically, it needs to be qualified by the further statement that any machinery employed must be thoroughly well built, not liable to break down, and be within the ability of the average fireman to work it. Also it must be adapted to work at the highest rates without causing smoke nuisance. Of course, where there are different interests concerned, opinions will differ extensively as to which manufacturer's machine best meets these requirements. An engineer who has had an unfortunate experience with one type is very liable to cry out "a plague on *all* your houses," and vow never to depart again from the steady, if somewhat inefficient, method of ordinary hand firing. It is obvious, however, that such an attitude in no way helps towards a real settlement of the question.

It is not very profitable to dispute about the traditions of any subject, but I have no need to run away from any statement made by me in my first letter, and I will, therefore, repeat what I then stated, that the method of firing in which the coal is piled up in the centre, thinning towards the sides, is a very ancient method of hand-firing; it used to be defended on the ground that the volatile matters from the fuel had a better chance of complete combustion. Of course, there have been in the past, just as there are now, different views on this matter, but I never said that this was the *only* ancient system.

It would not be possible in a letter to attempt to set out the results which have been practically attained by the overfeeding, as compared with the underfeeding system. But the reasons for concluding that the former is theoretically correct, may be briefly summarised as follows:—The fresh coal supplied to the fire is so placed that the volatile matters (which need the largest relative amount of air for combustion) begin at once to be distilled out of the fuel, which occupies such a position that the requisite supply of air is directly available; thus, smoke is avoided, and the whole of the heat is generated just where it can be of use. The fixed carbon of the fuel has then the advantage of the high temperature produced by the combustion of the volatile matter (which though very valuable as a heat producer, is somewhat slow to burn completely) to be entirely consumed by the time it reaches the end of the grate.

It is certainly not correct to state that, with overfeed methods when correctly used, there is "a big, thick fire at the front, and none at the back." If this is an accurate description of what "Engineer" has seen of this method of machine firing, it only shows that he has never seen the system properly worked.

In reply to the editorial comment appended to my previous letter, in your issue of the 20th ult., I would suggest that the writers take an early opportunity of personally inspecting the combustion taking place at the Burnley electricity works, where the underfeed system is applied. They will then be in a position to collect their own evidence as to the behaviour of the flame during the processes of combustion.

With respect to the discarded underfeeds, I alluded, of course, to the ancient types, which I think was obvious from the context.

Radix.

December 3rd, 1908.

The First Brake Report.

I have been very interested in reading your leader on the first brake report in your issue of November 20th.

As you are aware, I have contended all along that there should be at least two brakes on a car, one being alternative to the other, and capable of controlling it under both normal and extreme conditions.

Given very moderate gradients, then a slipper, magnetic, or rheostatic electric brake, combined with a hand-brake equipment, would generally satisfy this requirement; that is to say, on the one failing under proper treatment, the other could be relied upon to regain control. Improperly treat, however, the second and third combination, and failure results.

Now consider the conditions on dangerous gradients; past experience shows that gradients as reasonable as 1 in 20 can come under this category, and the two-brake equipment conforming with the requirements set out above, is almost non-existant. The contingency described in your leader clearly *shows* one of such cases.

To contend that cars have an alternative equipment, which is only true when conditions are normal—that is to say, when speeds are low, track conditions are favourable, and the personal element properly under control, is no true answer. I am pleased to see that since the publication of the undoubtedly valuable report of the Tramways and Light Railways Association, you still support this view of the case.

From our past experience of accidents, and particularly so in the case of the 15 referred to in the report, it would seem that this view of the case, notwithstanding the drastic and important revisions of present methods incurred thereby, will in the future command still further consideration.

P. J. Pringle.

Electricity and Tramways Department,
Burton-on-Trent, *December 7th*, 1908.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Electrical Sounding Device.

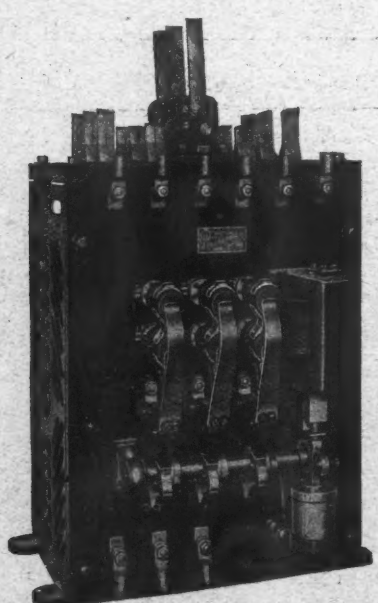
A simple device for continuous sounding has been invented by Mr. A. Schoretau. It consists of a chamber C with corrugated walls, enclosing a quantity of mercury. Two resistance wires W, W_1, contained in the glass tube T, dip into the mercury, and the

Sounding Device.

whole is made watertight. The pressure of the water upon the flexible walls of the chamber drives the mercury up the tube to a distance depending upon the depth, thus varying the resistance of the instrument, which can be measured on board the ship and gives a means of determining the depth without hauling up the "lead."

Lift Controller.

A new form of Schureman lift controller, which has been designed for use with alternating current where the control is by a rope passing through the lift, is being introduced by Messrs. Wm. Geipel & Co., Vulcan Works, St. Thomas Street, S.E. The controller is made for two and three-phase motors only. From the accompanying illustration, which shows the 10 h.p. size, it will be seen that there is a reversing switch at the top which is operated by the hand-rope. It has three definite positions, "up," "down" and "off" respectively; no intermediate positions are possible, so that accidental burning of

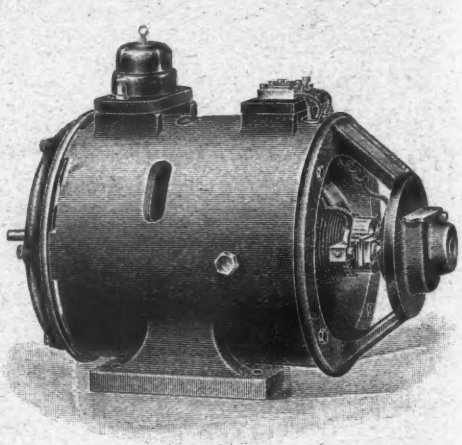


Lift Controller.

the contacts is obviated. When the switch is closed, the motor starts with all resistance in circuit. The resistance, which is star connected, is cut out by short-circuiting switches operated through a cam shaft which is actuated by a solenoid. This solenoid contains the only coil in the apparatus, and it is heavily wound, with a large margin of safety. The rate at which the resistance is cut out is regulated by the adjustment of a dash-pot. The arrangement is such that upon the failure of the supply or opening of the reversing switch by the movement of the rope, all resistance is instantly inserted, whilst it is not possible to reverse the direction of running without first inserting the resistance. The switches are of heavy construction, with carbon contacts, and every part of the apparatus is readily renewable. The resistance material consists of German silver wound in coils, in which a large margin of capacity is provided. The sizes constructed range from 5 to 25 h.p.

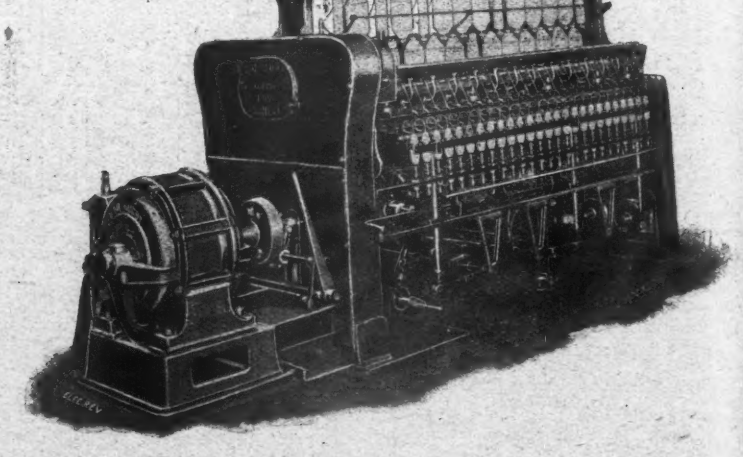
New Rotary Transformer.

In the accompanying illustration we show a new combined alternating to continuous-current transformer, which is being supplied by the Crypto Electrical Co., of Bermondsey Street, S.E. The machine has been designed to enable those situated on alternating-current mains to charge ignition accumulators off the mains in an efficient way. We understand, indeed, that the firm have redesigned the machine throughout, they having found that with



A.C.—D.C. Motor-Generator.

the old machine it was impossible to obtain more than 100 watts on the secondary without the machine overheating; they have therefore made both the motor and the dynamo considerably larger in order to overcome this objection. The machine is now capable of giving 120 watts output, namely, 15 volts, 8 amperes, and this is listed at 7 amperes output. It is fitted with radial carbon brushes instead of copper gauze as previously, and it is found that by slightly increasing the size of the dynamo the same output with carbon brushes as with copper is obtained.



Motor-Driven Spinning Frame.

An Electrically-Driven Spinning Frame Exhibit.

Among the numerous textile exhibits at the Manchester Exhibition was a 52-spindle ring spinning frame, by Messrs. Brooks and Doxey, Ltd., driven by a British Thomson-Houston motor and shown on the latter company's stand.

Our illustration shows the frame and motor, the latter being of 7½ b.h.p., of the three-phase squirrel-cage type, running at 960 r.p.m. and driving through a Whittaker-Hall friction clutch. This combination was shown in operation, spinning yarn from roving supplied by the Acme Spinning Co.

PROCEEDINGS OF INSTITUTIONS.

The Discharge of Electricity from Glowing Bodies.

By Prof. E. Rutherford.

(*Abstract of a lecture delivered before the* Institution of Electrical Engineers *at Manchester, November 17th*, 1908.)

Ionised gas may be produced in a variety of ways, *e.g.*, by the application of X-rays, cathode rays, high temperature or ultra-violet light. If two metal plates, separated by air, be connected to a battery of electrical accumulators, no current will flow under normal conditions, but if the dielectric be subjected to the influence of X-rays, ionisation takes place, and a current of electricity actually passes through the gas. This effect is explained by the fact that the X-rays cause a dissociation of the air molecules, giving rise to positive and negative particles. Immediately these particles are liberated, they tend to move in two streams, the positive particles going to the negative plate, and *vice versâ*. Ionised gas, therefore, becomes a conductor, the ions themselves representing not only the conducting medium, but actually the current. If a curve be plotted showing how the current through the gas varies with the potential difference between the plates, it will be found that up to a certain point, the current is directly proportional to the voltage. This is explained by stating that at low voltages the speed of the ions from plate to plate is relatively slow, and many recombinations take place before the ions reach their destination. As the voltage is increased, however, a saturation point is reached when there is no further increase in current, and at this stage all the ions succeed in reaching their goal, hence they are all actively engaged as current carriers, and a further increase in current cannot take place. Ohm's law fails in application when dealing with ionised gas; for example, in the case just mentioned, if the distance between the plates be reduced by half, only half the number of ions will be formed, hence the current will be halved instead of doubled as prescribed by Ohm's law.

The above effects are obtained similarly *in vacuo*, the only difference being that the saturation point is reached much more quickly owing to the more rapid motion of the ions.

Townsend investigated the cause of breakdown of the dielectric by an electric spark passing from plate to plate, and this he attributed to ionisation by collision.

A negative ion on making its way to the positive plate collides with a molecule, and if its velocity is greater than, say, 10^8 cm. per second, it separates the ions in the molecule, and proceeds to cause further dissociation. This ionisation by collision continues, causing the rapid formation of positive and negative ions, and at a certain voltage a spark passes which alters the whole condition; this latter condition has still to be investigated.

A good illustration of ionisation is formed by placing two platinum wires forming the terminals of a battery in different parts of a Bunsen flame. The flame itself, being an ionised gas, permits an appreciable current to flow, and this current can be further increased by the addition of potassium or sodium salts to the flame. It is interesting to note also that one of the platinum wires may be withdrawn from actual contact with the flame and still permit the current to flow, owing to a number of the ions straying to the outside air.

The effect of high temperatures in producing ionisation can be readily explored by surrounding a platinum wire by a metal cylinder so as to form a kind of condenser *in vacuo*. Now if the wire and cylinder form the electrodes of a battery (the wire being at negative potential relatively to the cylinder), and a separate source of current is employed to heat the wire, ionisation will take place, thereby permitting a current to flow between the wire and cylinder. The value of this current can be derived from the expression—

$$c = a\,\theta^{-\frac{1}{2}}\,e^{-\frac{b}{\theta}};$$

where a and b are constants, θ is the absolute temperature, and e is the base of Nap. logs.

Thomson states that such a wire has many negative particles retained in some way by the surface: at high temperature the particles break through, and are thrown out, the wire itself constituting an additional repelling force when negative. Obviously when the wire is positive it tends to retain the particles. These effects were demonstrated some years ago by Fleming in his well-known carbon-filament experiments. Wehnelt has shown that a platinum plate coated with calcium or barium salts has a greatly increased power of emitting electrons, and by this method currents at the rate of 1 ampere per sq. cm. are easily obtained.

A special vacuum tube designed to demonstrate these effects consists of a long glass cylinder, having at one end a simple platinum wire electrode and a similar starting electrode about midway in the tube. The negative electrode situated at the remaining end of the tube consists of a strip of platinum coated with lime, which can be heated electrically by an external battery. It is found that in order to start the flow of current through the tube the two platinum wire electrodes must be short-circuited, thereby affording a shorter path for the ions emitted from the heated lime. Afterwards, however, ionisation by collision takes place and permits the end electrode only to be used. This apparatus permits eight electric lamps, taking 5 amperes, to be lighted through the tube from a 200-volt supply circuit, the area of the lime surface being only $\frac{1}{4}$ sq. mm.

A Comparison of Natural and Induced Draught Systems.

By W. N. Y. King, A.C.G.I., Associate Member.

(*Abstract of Paper read before the* Institution of Electrical Engineers *at Leeds, November 25th*, 1908.)

The heat lost in the flue gases is often 20 to 25 per cent. of the total available energy of the fuel; this loss is inherent to the natural-draught system. The induced-draught system is preferred to forced draught for land purposes, and does not necessitate the waste of any considerable proportion of energy.

Natural draught depends upon the flue gases being at a higher temperature, and, therefore, less dense than the air outside the chimney, though the difference in density is slightly diminished by the presence of carbon dioxide in the former. The draught is given by the formula—

$$p = 7{\cdot}6\ H\left(\frac{1}{T_2} - \frac{1}{T_1}\right) \text{ in inches of water,}$$

where H is the height of chimney top above grate, in feet; T_1 is the mean temperature of the internal gases, and T_2 that of the atmosphere, in degrees F. absolute (°F. + 460).

The accompanying figure gives the height of chimney required to produce draught pressures of 1 in. and $1\frac{1}{2}$ in. respectively (curves A_1, A_2), and the draught pressures produced by chimneys 150, 186 and 80 ft. in height respectively (curves B, C, D), with different chimney gas temperatures, the temperature of the atmosphere being taken as 70° F. and the barometer normal. About 5 per cent. of the draught is lost through friction in the chimney itself.

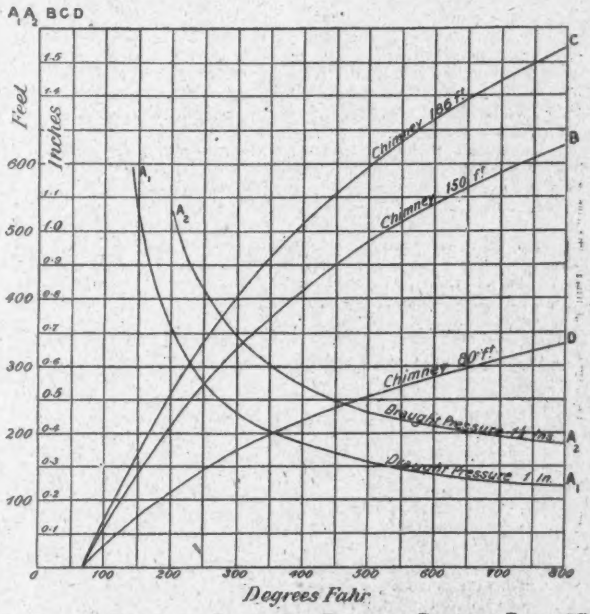


Fig. 1.—Height of Chimney in Feet and Draught Pressure in Inches of Water. Temperature of Atmosphere, 70° F.

To avoid undue loss in friction, 10 ft. per second is a good working velocity for the flue gases, and 16 ft. per second should not be exceeded.

In an installation consisting of two Stirling five-drum boilers, built together in one casing, and one Sirocco fan driven by a Crompton motor of 35 B.H.P. at 300-600 R.P.M., with a short chimney, the following results were obtained.

The boilers had a grate area of 59·5 sq. ft., and were fitted with Babcock & Wilcox chain-grate stokers; the heating surface was 3,450 sq. ft. each; superheating surface, 188 sq. ft. each; and the evaporative capacity was 12,500 lb. per hour from and at 212° F., the working pressure being 165 lb. per sq. in. The fan was rated at 45,000 cb. ft. per minute, against $2\frac{1}{2}$ in. water pressure.

In a six-hour test, one boiler consumed 1,232 lb. per hour of washed nuts and evaporated 14,860 lb. per hour (equivalent from and at) with an average superheat of 100° F.; the feed-water temperature was 42° F., and the flue gases at fan intake were at 439° F. The draught pressure was 1·04 in., CO_2 13 to 14 per cent., thickness of coal feed, 4 in.; and speed of grate, 4 in. per minute. The motor, working on both boilers, took 7·56 KW. at 262 R.P.M.; draught, 0·88 in.; 9·2 KW. at 330 R.P.M., 1·25 in.; and 10·8 KW. at 396 R.P.M., 1·6 in.

Assuming that the maximum temperature of the gases was 2,800° F., and that the atmospheric temperature was 70° F., the loss of heat in the flue gases was 13·5 per cent., and with a draught of 1·04 in. the fan motor took 8·1 KW., representing 1·31 per cent.

A natural-draught chimney for the same draught would be 186 ft. high and 6 ft. in diameter, the flue gases entering it at the same temperature as above.

An economiser could have been installed with advantage with the induced-draught system, and the gases could have been reduced to 350° F., beyond which the economy is questionable. The fan plant is fixed above the back-end of the boilers; it weighs 3 tons.

and the chimney, of $\frac{3}{16}$-in. steel plate, 4 ft. 6 in. in diameter, and 80 ft. high, weighs over 2½ tons. No floor space is occupied, whereas the brick chimney would require an external diameter at the base of 16 ft., and a total area of 201 sq. ft.—39 per cent. of the floor space occupied by the two boilers—and its weight would be over 800 tons, exclusive of foundations.

It is only on steady load that a chimney gives its full efficiency, whereas fan draught can be controlled to suit the requirements of the moment, and forced in case of emergency.

The relative costs depend greatly upon the daily length of service. Allowing the capital cost of the chimney to be £1,000, and of the fan plant £300, the total cost of the former for interest, depreciation and maintenance is £90, while these items in the case of the latter came to £36. Adding the running costs to the latter, the total for 20 hours a day is £159; for 10 hours, £97·5; for five hours, £66·8; and for 2½ hours, £51·4, so that up to about nine hours a day the fan is the cheaper. This assumes that the temperature of the flue gases in each case is 439° F.; if the temperature in the case of the chimney were 35° F. higher than with induced draught, the extra heat loss would cancel out with the power required to drive the fan, and the latter would then always be the cheaper.

It is essential to economical working that the fan draught and the coal feed be kept properly adjusted to the load, especially when the load is falling.

Electric Power for Small Consumers.

A paper on this subject was read at a recent meeting of the Birmingham and District Electric Club, by Mr. Vincent E. Walters.

For the purposes of the paper the term "small consumers" was taken to mean those whose power installations did not exceed 50 h.p.; this arbitrary limit was fixed for the reason that it included generally those whom it was most difficult to persuade to adopt electric power, partly due to financial reasons, and partly to lack of education. The small power-user included, first, shopkeepers, such as grocers, barbers, bootmakers, and the like, who might require anything between ¼ B.H.P. and 5 B.H.P. Secondly, there was the growing use of electric lifts in hotels, office buildings, and warehouses. In the case of 15-cwt. goods lift, running on a 200-volt, 50-cycle single-phase circuit, tested for seven hours, the total number of journeys was 128, and the total weight carried was 30 tons 7 cwt.; the energy consumed amounted to only 2½ units, costing at 2d. per unit, 5d. Readings taken over several weeks showed that the average cost of energy never exceeded 2s. 6d. per week, though its price, 2d. per unit, was considerably higher than could be obtained in many localities. Thirdly, there was the manufacturer requiring anything up to 50 B.H.P., for an immense variety of processes, and it was here that electric power met the keenest competition.

The annual bill for electricity, coal, or gas, as the case might be, was often the sole basis on which the manufacturer decided his method of driving, but the power costs of a factory were in most cases small compared with the whole costs and standing charges, and a year's total of this item might be easily exceeded by the avoidable losses due to an inadequate output from the plant installed. Increased output due to the adoption of the electric drive was chiefly owing to the fact that an electric motor was run at a practically constant speed at all loads within its rated capacity, which was not the case with a steam or gas engine. On substituting electric motors for a gas engine driving a number of polishing bobs, it was found after 18 months' experience, that work which had formerly taken seven days to produce was now done in six with the same number of machines in use, whilst the bobs lasted 12 months' longer with the electric drive than with the gas engine drive, owing to the steadier speed obtained.

An article in the Electrical Review a year or so ago gave some very pertinent figures relating to a hosiery works, where the steadier and more constant speed of the electric drive which replaced a gas engine installation, not only produced more even and better cloth, but by avoiding breakages caused by excessive speed and loss of time due to stoppages to rectify uneven work, actually saved a loss of £1,350 per annum, representing the output of four frames, which loss was directly traceable to the fluctuating speed of the gas engine.

Assuming a public supply of electricity at reasonable rates to be available, it would be generally found advantageous to make use of this rather than put down a private power plant, even when the installation was of a very extensive character. The chief advantages obtained by this were as follows:—

1. Low capital cost of plant, and consequent reduction of annual charges for interest and depreciation.
2. Saving of space.
3. Saving of attendance.
4. Reliability of supply.
5. Reduction of rates and insurance premiums.

That the suction gas engine was highly economical, was, of course, an established fact, and it had its definite place in isolated districts where no public supply was available or where fuel was dear. When running on a constant load, where close speed regulation was not required, it was probably unrivalled. But such cases were not usual, and due allowance in estimating costs must be made for the heavy repairs necessitated after a few years' working in most cases. It was very rarely that a shop required its full load continuously, and experience had shown that an average load factor for a plant of about 40 h.p. was from ·5 to ·75. Individual motor driving under suitable conditions enabled the fullest advantages to be derived from the use of electric power both as to economy and increased output.

A suction gas engine had a very small margin of overload, and it must be borne in mind when purchasing that the continuous full load was often much less than the maximum effective load.

The fact that the advantages of electric power were largely indirect increased the difficulty of persuading the prospective customer that it was to his benefit to adopt it. The annual charge for energy constituted the bulk of the cost of electric driving, but with a suction gas engine and plant, for example, the cost of fuel was a relatively small proportion of the total power costs, and it was often a difficult matter to drive this home.

There were few towns of any size nowadays where it was not possible to obtain motors on hire at a very low rate, the cost of fixing and wiring being usually only a comparatively small percentage of the initial cost of the motor, and for a new plant the electric installation would generally involve a much smaller outlay than any other form of power. There was no doubt that with increased knowledge and use of electricity generally, together with the gradual reduction in charges for electrical energy and the low cost of apparatus, the small power-user would soon almost universally adopt electricity as a motive power, with the greatest benefit to himself and his employés, as well as to the general public, by making their towns cleaner and healthier.

Electric Winding.

Mr. Gerald Hooghwinkel, M.I.E.E., M.I.M.E., read an interesting paper before the members of the South Wales Institute of Engineers at Cardiff last week, in which he described the electrical winding engine at the Maritime pit of the Great Western Colliery Co. This is the first electrical winding engine of moderate capacity at work in South Wales, and for that matter in the United Kingdom, being required to wind 175 tons of coal per hour from a depth of 1,110 ft. in 70 winds. Given favourable conditions as to loads, depth, and above all, banking conditions, combined with a low price for electrical power, it could be shown that electric winding could be performed, at least as safely as, and at no greater cost than, with steam. Among the points which had altered the conditions in favour of electric winding might be mentioned the increasing value of small coal in South Wales and the decreased cost of electric power. It was a controversial point as to what price power could be supplied at, but he claimed to have obtained figures varying between 0·25d. and 0·4d., including 10 per cent. for interest and depreciation with colliery power stations varying between 1,000 and 5,000 kw. installed, using coal at 8s. per ton. Power supply company figures were generally somewhat higher, but they might be expected to come down to the figures stated in the course of time. As regards the winder under notice, the Westinghouse system was adopted, whereby a three-phase motor was used, capable of being run direct from the mains. The absence of recuperative power with this system, was met by an ingeniously designed drum, which, if properly handled, stopped without any braking being required after the current was cut off. The plant had been in continual use for about four months, and the engine had proved to be easily able to deal with the requirements. The cost of winding at one trial was brought down well under 2·23d. per ton, which steam winding would have cost.

Institution of Electrical Engineers, Newcastle-on-Tyne.

At the meeting of this Local Section on the 16th ult., Mr. A. L. E. Drummond delivered his address as chairman. He gave some striking figures as to the growth of the telephone; on the National Telephone Co.'s system, he said, there were nearly 1,450 exchanges, to which were connected approximately 450,000 stations, working on 1,100,000 miles of wire, representing an increase during the last five years of 400 exchanges, 170,000 stations, and 653,000 miles of wire. On the Post Office system there were approximately 30,000 stations. According to the Postmaster-General's report for the year ended March 31st, 1908, the number of trunk wire centres had increased from 533 to 551, and 342 new trunk circuits had been provided during the year, increasing the mileage to 80,000 miles of double wire. The conversations on such lines showed an increase of 11 per cent. upon the record for the previous year, and the average value per call had increased from 5·82d. to 5·84d. Mr. Drummond pointed out the unsatisfactory nature of the flat-rate, in view of the rapid increase of the use of the telephone. The National Telephone Co. employed about 18,000 persons, and the calls numbered about 12¼ millions, without counting trunk calls, which amounted to about 400,000 calls per week.

Referring to the education of electrical engineers, he said that the question had always been before them whether it was desirable that the budding engineer should devote the early years after leaving school to continuing his studies at the college, or should at once go into the shops for practical experience; or whether it would be better that some combination of both theoretical and practical training should be arranged. It appeared that a happy medium, or a combination, would best meet the case. Personally, he considered that the employers would best serve their own interests by rearranging the present shop hours. If the apprentices who were known to be attending classes were allowed some grace in this matter, it would be fully appreciated by the lads, and there would not be the present waste of time in the morning. He also considered that more direction should be given to the student as to what course of study was most suitable for him.

Speaking upon developments in the Tyneside district, he said there had been a very considerable development in power distri-

bution, and it was gratifying to find that the Carville power station at Wallsend was stated to have increased its output fourfold during the past four years, and to have now the greatest output of any power station in Europe; and, further, that this station, in conjunction with its affiliated concerns, generated about one-quarter of the whole of the electricity supplied by public companies in the United Kingdom. Further extensions were under construction. This power development naturally suggested turbines, and in Newcastle all felt a pride in still having amongst them the inventor of the most popular turbine of the day.

Transformers: Some Theoretical and Practical Considerations.

By A. P. M. FLEMING and K. M. FAYE-HANSEN, Associate Members.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at Manchester, December 1st*, 1908.)

UNLIKE other classes of electrical machinery, transformer design has not settled down to one type. As regards iron loss, regulation and efficiency, there is little to choose between the various types when correctly designed. The authors have developed for each of the standard types a mathematical method of determining the cheapest transformer under given conditions, and they give tables showing the dimensions of high and low-pressure transformers of the four principal types—shell type, rectangular and circular, and core type, with rectangular core and with circular core. The amount of material required is practically the same for each type, and the cost does not greatly vary. Assuming the transformers to be worked at full load, as in power work, and again, designing them to have maximum efficiency at two-thirds full load, as in lighting work, the maximum efficiency is about the same in each case, no type having any special advantage. The reactance of any type depends upon the arrangement of the windings, and can be widely varied. The proportions of the dimensions may be considerably modified without appreciably influencing the price of the active material. As regards cooling, by providing special ventilating ducts, &c., it is possible to keep any type of transformer cool; in

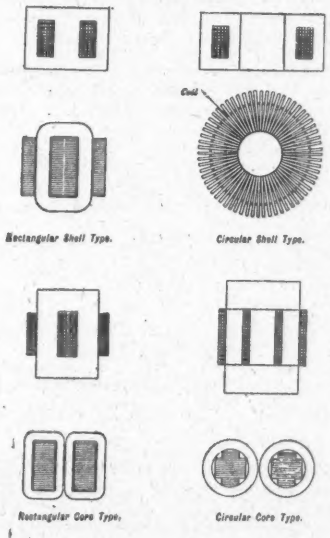


FIG. 1.—TYPES OF TRANSFORMERS.

the absence of such provision, the core type offers the best facilities for cooling the copper, and especially the circular core type. The cooling can be greatly assisted in rectangular designs with sandwich windings, by spreading the coils outside the iron. The circular shell type is inferior to the others as regards the cooling of the copper, but superior as regards the iron. In all types the space factor is about the same, except in the case of core types with double concentric winding, which have a smaller copper space factor than the others. The various types, in general, are practically equal in all respects, except that the rectangular shell type shows a slight superiority on the whole.

The demand for high efficiencies compels manufacturers to use high space factors, so that the insulation is cut fine, and the reliability of the transformer reduced. Modern iron alloys of high magnetic qualities have greatly assisted the manufacturer, enabling the same maximum efficiency to be obtained with about half the original weight.

Assuming that the cost of the alloyed iron is double that of ordinary transformer sheet-iron, and the loss per lb. is 60 per cent. for the same induction and frequency, it is found that whenever the size of the transformer is limited by efficiency, it will be of advantage to use the alloyed iron; this holds good also, though to a less degree, when the limit is heating, but the advantage is somewhat diminished by the increased no-load current. The tendency is for the special alloyed iron to bring transformers of much higher efficiency and little, if any, higher cost to the front. The construction and cooling of these is cheaper, as the dimensions and losses are smaller.

It is often stated that the ideal condition is to obtain the maximum all-day efficiency, but this is not correct, as the iron loss is constant, but the copper loss is a maximum when the load is maximum, so that the unit of copper loss costs more than the unit of

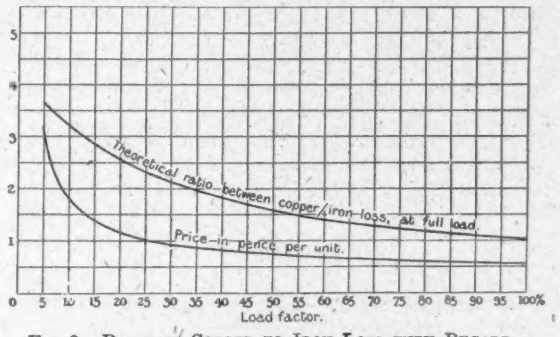

Theoretical ratio between copper/iron-loss, at full load.
Price in pence per unit.
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100%
Load factor.

FIG. 2.—RATIO OF COPPER TO IRON LOSS, WITH REGARD TO LOAD FACTOR.

iron loss. The accompanying curve shows how the ratio of copper loss to iron loss should vary with the load factor, the price curve being plotted from figures given in Mr. Snell's paper of January 17th, 1908.* It would, however, be good practice to make the ratio smaller than according to this curve; for ordinary voltages 80 per cent. of the values given is recommended, and for very high voltages the ratio should be lower still.

The most important difference between the various types of transformer is the method of cooling; efficient cooling is essential, in order to minimise fire risk, and to prevent deterioration of the insulation, ageing of the iron, and increase in copper loss.

Natural-draught cooling is automatic, but impracticable for large outputs; oil-insulated self-cooling transformers can be built for very much greater output, and can carry much larger overloads, while the insulating materials do not deteriorate so rapidly, and high pressures can be safely carried. The economic limit of the oil-insulated self-cooling type is at present about 1,500-2,000 K.V.A. at 50 cycles.

For larger sizes, artificial cooling is necessary. The oil-insulated water-cooled type is the most reliable and economical, if ample water is available without pumping; otherwise air cooling is required. The air-blast type without oil insulation cannot be used for high voltage, and if the air blast fails the transformer heats rapidly; the oil-insulated type is free from these disadvantages, and, owing to the large thermal capacity of the oil, can carry overloads for considerable periods.

The maximum temperature should not exceed 85° C. for long, and therefore the temperature of the surroundings must be kept down; transformer chambers containing self-cooling transformers should be adequately ventilated—a point which is often overlooked even by prominent engineers.

The durability of the internal insulation depends on workmanship and the mechanical properties of the materials. In large transformers for very high voltages special insulation is required for the end turns, unless heavily-insulated choking coils are used outside the transformer in series with the high-pressure windings.

In the case of very high voltages the principal insulation difficulty is met with in bringing the ends of the conductors out of the case; to cope with this, alternate cylinders of insulation and metal foil surrounding the terminals have recently been used, forming condensers of similar capacity in series, across which the potential gradient is uniform.

Mechanical stresses on the windings must not be ignored; the electromagnetic stresses are proportional to the square of the current flowing, and on short-circuits they may amount to 10,000 times the normal stresses. In the case of a 1,200-K.V.A. three-phase transformer having a close regulation, the forces tending to displace the winding have been calculated to be 2·8 tons for the coil nearest to the yoke. The tendency to obtain closer and closer regulation increases this danger, besides rendering it more difficult to parallel transformers, as a small difference in the ratio will cause heavy circulating currents.

It is very difficult to make oil tanks entirely impervious to oil; small transformers can be put in galvanised or enamelled cast-iron tanks; larger ones require sheet-iron tanks with soldered joints, or boiler-iron tanks riveted and caulked by experts in this work.

There is little fire risk from the oil used to insulate transformers; but where large quantities of oil are used, the transformers should be mounted in separate fire-proof chambers, or means should be provided to draw off the oil in case of need.

Mexico.—The Guadalajara Electric Light and Power Co. is going to construct a new electric transmission about 130 km. (81 miles) long, which will serve as a stand-by in case of accident. The cables will be carried on iron standards; sub-stations will be erected every 15 km. (about 9 miles).—*Board of Trade Journal.*

* ELECTRICAL REVIEW, January 24th, 1908.

BUSINESS NOTES.

Tantalum Lamps for Railways.—Messrs. Siemens Bros. Dynamo Works, Ltd., of 6, Bath Street, City Road, inform us that in June last they fitted up a carriage upon the Great Northern and City Railway with 15 tantalum lamps; of these, two have broken to date, while the remaining 13 have now run for 2,000 hours without failure or serious decrease in candle-power. Out of a large number of lamps used in the stations of this railway, 75 per cent. have burned for about 2,000 hours, and are still in use, while the remaining 25 per cent. (excluding four lamps, which broke down through mechanical defects), gave an average life of 1,300 hours. As a result of these tests, the Great Northern and City Railway propose to displace their carbon-fil ment lamps, and use tantalum lamps for both train and station lighting.

Jandus Regenerative Flame Lamps.—We understand that these lamps can now be supplied adjusted for 10 amperes at 55 volts, four in series on 220 volts, &c., enabling open type lamps to be replaced without alteration to the wiring. It is stated that under the new conditions, none of the usual features of these lamps, viz., 70 hours burning with one pair of carbons, high candle power, low running costs, &c., will be sacrificed. The original form of lamp, 5-ampere singly on 100-120, two on 200-250 volts, &c., which has proved so successful, will still be supplied. Full details will be supplied by the sole agents for the Jandus Co., Messrs. Drake & Gorham, Ltd., 66, Victoria Street, London, S.W.

Consular Notes.—Italy.—The Austrian Consul at Naples, in a recent report, states that steam engines and boilers are now being built in Italy, and the demand for the latter from abroad has almost disappeared. Steam engines are still imported from Switzerland and Great Britain and semi-stationary locomobiles from Germany. The introduction of suction gas engines has almost eliminated the use of steam engines and locomobiles in industrial enterprises. Suction gas engines are built by a few large firms in Italy, but they are also imported from Great Britain, Switzerland and Germany. Petroleum and benzine motors are imported from Great Britain, United States, Germany, but only in small quantities as yet; the demand may, however, increase as a result of the reduction of duty on petroleum. Steam pumps are imported from Great Britain and Germany, mills from Switzerland, Germany and Hungary. The production of these in Italy is on the increase. Machine tools are imported chiefly from Germany, both for metal and wood working. A few are also imported from the United States, but the importation from Great Britain is decreasing. Electrical machines are imported chiefly from Germany, but the home industry is developing. The sale of machines of foreign construction is carried on, as a rule, through agents, who buy for their own account, and sell to the consumer. Business during 1907 was very satisfactory. The nationalisation of the railways has had a very favourable influence not only on the trade in machines, but also in supplies for railway construction, &c.

Spain.—The British Consul at Bilbao, in a recent report, states that there is an important factory situated in Bilbao for the building of railway trucks, which supplies most of the Spanish railways. This factory also constructs a certain number of passenger carriages. Formerly the wheels and axles for this factory were obtained in the United Kingdom, but recently they have been purchased in Belgium. The Construcciones Metalicas Co. own large works at Beasain (province of Guipuzcoa); they make railway wagons, tramway cars, wheels, axles, and springs for railway and mining wagons, and do general foundry work. They employ about 850 men. A firm at Passjes have also erected a factory for carriage and wagon springs, but so far they employ only about 35 men. The machinery trade during 1907 was adversely affected by the depression in the iron ore market, and it is said that very few good orders were booked. One important British firm of machinery makers has a branch establishment in Bilbao, and several other British manufacturers are represented by agents who have showrooms under their respective names, and carry stocks of British, as well as foreign-made, machinery and accessories. 9,249 tons of rails were exported to Mexico during 1907. A Spanish firm were successful tenderers for the supply of some 22,000 tons of rails to the Turkish Government for the Haifa railway. The same firm have also contracted to deliver some 5,200 tons of rails and fishplates for a railway in Finland.

All the electric lighting companies in Bilbao and neighbourhood, with the exception of the Co-operativa Electrica (with 1,500 consumers) have united as one company under the name of Union Electrica Vizcaina with a capital of 18,000,000 pesetas, of which 16,000,000 pesetas have been issued. It is said that one of the fundamental conditions in the formation of this company is that they will supply both power and light at prices which are not to exceed those at present ruling, viz, 50 cents per unit. The Hidro Electrica Iberica Co. supply power at the following prices:—

24 hours' daily supply (Sundays excepted) 300 pesetas per H.P. per annum.
12 hours' daily supply, 200 pesetas per H.P. per annum.
24 hours' daily supply (during nine winter months), 17 pesetas per H.P. per month.

These prices are for minimum supplies of 100 H.P. If smaller quantities of power are required, an extra 50 pesetas per H.P. per annum is charged. In June, 1908, new works for supplying electric light and power to Santander were completed. The Consul has learned that a Glasgow firm have just completed (July, 1908) the erection of an electric power station of 300 to 400 H.P. at their iron mines situated at Camargo, near Santander, to be used for washing ore, haulage, and lighting purposes. The machinery has been supplied by another Glasgow firm. In the north of Spain buyers are so accustomed to deal with German and Swiss firms only in the electrical machinery trade, that it is difficult to make them believe that similar goods are manufactured in the United Kingdom, and the only practical way for securing any share of this trade is for British firms to combine to open branches in Spain carrying representative stocks and with a staff of technical experts who can speak Spanish. The Consul's opinion is that the electrical machinery and motor trade in Spain possesses considerable potentialities, but British industry must adopt aggressive tactics to derive advantage from them. The Bilbao Tramway Co., a Belgian firm, are erecting a large power station at Burcena (on the bank of the Bilbao River). The machinery comprises two steam turbine sets of about 2,600 H.P. each, with Babcock boilers. The tramway company have agreed to sell power to the Hidro Electrica Co. during the summer months from the Burcena station at 7 cents. per KW. per hour, whilst in the winter months, when the latter company have abundant supply from their waterfalls, the tramway company will purchase from the Hidro Electrica at 4½ cents per KW. per hour.

The Austrian Consul at Barcelona reports that the Sociedad la Industria Electrica has recently been formed in Bilbao, and proposes to establish works for the production of incandescent electric lamps. The works are to be fitted up with the most modern machinery and appliances. The daily production of this company is fixed at 600 to 1,000 lamps, but the works are designed to admit of an output of 5,000 lamps. This factory is the fourth of its kind to be established in Spain.

Dissolutions and Liquidations.—In the Isle of Man Chancery Court last week, Mr. W. H. Walker, of Liverpool, liquidator of the Isle of Man Tramways and Electric Power Co., Ltd., applied to have his accounts passed. It was stated that dividends of 13s. 6$\frac{11}{12}$d. had been paid to the ordinary creditors, and there remained in hand 19s. 2d., the amount of unclaimed dividends. The Judge directed that these unclaimed dividends should be posted to the creditors concerned, and gave instructions as to notices of a petition for the dissolution of the company, the petition being adjourned for a fortnight.

Mutual Telephone Co., Ltd.—A meeting is to be held at 6, Booth Street, Manchester, on January 5th, to hear an account of the winding-up from the liquidators, Messrs. W. Thomson and F. Scott.

Messrs. Townson, Chadwick & Co., mechanical and electrical engineers, 118, Bark Street, Bolton.—Messrs. E. Townson and A. Chadwick have dissolved partnership. Messrs. Harper, Pilling and Harper, 23, Acresfield, Bolton, will attend to debts.

South America.—The *Demerara Chronicle* draws attention to a report made by the special agent, Mr. Charles Pepper, to the United States Department of Commerce and Labour. The report deals with the foreign trade of Peru, Ecuador, Chile, and Bolivia, and draws attention to the fact that the natural conditions of these countries do not favour the establishment of industries on a large scale, so that they will be always buyers of manufactured articles. The largest market is for railway material and mining machinery, but there is also a growing trade in electrical apparatus.

Bankruptcy Proceedings.—E. P. Oliver, electrical engineer (now or lately carrying on business as Newington, Priddle and Co.), 50, Great Sutton Street, Goswell Road, E.C.—December 19th is the last day for the receipt of proofs for intended dividend. Trustee, G. W. Chapman, Official Receiver, Bankruptcy Buildings, Carey Street, W.C.

Lamp Prices.—The Sunbeam Lamp Co., Ltd., have issued under date December 1st a circular announcing reductions in the list prices of their metal-filament lamps, instead of the increased trade discounts recently advised.

Trade Announcements.—Mr. A. Terry, of 93, Leadenhall Street, E.C., who is the sole British agent for the Mannheim India-Rubber, Gutta-Percha and Asbestos Works Co., Ltd., has recently returned from a visit to the works, where he found the company's business greatly on the increase. Considerable enlargements and improvements are being made in the ebonite department, and these will be completed in January.

Messrs. Blackburn & Layland, electrical engineers, have opened premises in Standishgate, Wigan.

Fittings Competition.—A competition, open to Italian firms and to foreign firms having branches or agents in Italy, has been arranged for the design, supply and installation of the ornamental electric light fittings required for the new Palazzo di Giustizia, Rome. Designs must be forwarded before February 8th to the Ingegnere Capo, Ufficio del Genio Civile, Rome, from whom further details may be obtained. A second and similar competition, returnable by January 24th, relates to the supply of transmission lines, lamps, &c., for the like service.

Catalogues and Lists.—MESSRS. STEWARTS & LLOYDS, LTD., 41, Oswald Street, Glasgow.—Circular giving a schedule of sizes of British standard pipe threads for iron and steel pipes and tubes authorised by the British Engineering Standards Committee, and announcing that from January 1st next tubes and fittings will be screwed British standard threads *when so ordered* by customers, and from July 1st, 1909, *unless otherwise ordered.*

THE DAVIS ELECTRICAL CO., LTD., 17, Moor Street, Cambridge Circus, W.—Leaflet setting out prices of their Waltham auto-transformers for use with metallic-filament lamps.

MESSRS. BEST & LLOYD, Cambray Works, Handsworth, Birmingham.—New catalogue, No. 68, of electric light fittings and accessories. It is in every way an excellent production, consisting of 190 large pages (art paper) wherein manifold illustrations appear of all classes and styles of fittings. A special effort has been made to ensure the comprehensiveness of the catalogue, and it certainly contains fittings of types suitable for all tastes—Adams, Louis XV and XVI, Sheraton, Georgian, Empire and Régence—but in addition to all of these, special designs are drawn up for special purposes. The catalogue starts off with such small details as lampholders, candle lamps, and switch-covers, and an ample selection of brackets, some simple, some elaborately ornate, leads on to table, desk, newel and floor standards, drop pendants, hall and vestibule lanterns, bedroom pendants, shade lights, and many admirable examples of suspension fittings, and electroliers, as well as ceiling fittings, "Surprise" and billiard pendants. Glass shades and shadeholders, together with indexes, complete the contents of a catalogue which will be very serviceable to contractors and the trade generally.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton.—Leaflet "X," illustrating and giving prices and other data concerning their voltage transformers for metallic-filament lamps, and including particulars of Osram lamps, and adaptors and galleries for same; also leaflet "D" dealing with their alternators, exciters and regulators, and giving prices for single, two and three-phase alternators at various speeds and voltages.

MESSRS. DAVID BROWN & SONS (HUDDERSFIELD), LTD., Park Gear Works, Lockwood, Huddersfield.—Twelve-page pamphlet containing a description of Spence's patent Centrip gear, which is a totally enclosed double reduction gear with straight line transmission, and consists of a pinion gearing with three spur wheels placed concentrically round it and equi-distant from one another, these being keyed to shafts, on each of which is also fixed a pinion which gears with a spur wheel, whose axis is in line with that of the first pinion. Some fine half-tone views are included.

THE UNIVERSAL ELECTRICAL MANUFACTURING CO., 14, Station Parade, Queen's Road, Peckham.—Illustrated catalogue consisting of a number of descriptive lists of their switchboards and switch-gear, ironclad switches and fuses, also their flame arc lamp and a new single enclosed arc lamp, arc lamp accessories, street lighting fittings, switch and feeder pillars, &c. In nearly every case one side of each sheet contains the descriptive particulars, the other giving price information in clear tabulated form.

MR. G. BRAULIK, 8, Lambeth Hill, London, E.C.—A number of leaflets describing various novelties, including multiple electric sign switches, speed meters, wire measuring apparatus, hot-wire and change-over switches, also light and dark switches for electric advertising signs, "Veritas" double time meters, &c.

THE ELECTRICAL CO., LTD., 121-5, Charing Cross Road, W.C.—Illustrated lists giving particulars of the "A.E.G." "Sunshine" flame arc lamps and their new 3-ampere Nernst lamps, with prices clearly shown in red.

MESSRS. MARPLES, LEACH & CO., LTD., Adnil Building, Artillery Lane, E.C.—Illustrated leaflet describing the "Adnil" vibratory generator, and their loud-speaking telephone with hooter call.

MR. G. WÜTHRICH, Norfolk Street, W.C.—Lists tabulating sizes, prices, &c., of Oerlikon three-phase enclosed squirrel-cage motors of from ½ to 8 H.P. and 9—55 H.P.

CAMBRIDGE SCIENTIFIC INSTRUMENT CO., LTD., Cambridge.—Leaflet containing an illustrated description of the Weston normal cell which was recommended by the recent Electrical Units Conference as a standard of electric pressure for the measurement of both E.M.F. and current.

MESSRS. MAVOR & COULSON, LTD., 47, King Street, Mile End, Glasgow.—This is a 16-page catalogue with excellent views, printed on art paper, together with descriptive information concerning the firm's three-phase generators and motors. Sizes, speeds, capacities, reference numbers, and prices are tabulated. A special table of prices of motor accessories, also a page devoted to dimensions and weights, are followed with details of the "Spinner" motor.

A Wimbledon Contract.—An arrangement has been arrived at with regard to the difference with MESSRS. JAMES HOWDEN & CO., LTD., respecting the amount of pipework included in their tender for the supply of a Zoelly turbine, &c., accepted by the Electricity Committee. At the last meeting of the Committee, however, the town clerk announced that the contract between the firm and the Corporation for a 1,000-KW. turbo-alternator had not yet been executed. The firm alleged that they tendered for a Howden-Zoelly turbine of 1,465 B.H.P., while the engineer contended that the arrangement was to supply a turbine of 3,000-B.H.P., similar to that erected by the company at the Powell Duffryn Collieries, and which was inspected by a sub-committee last March. Some correspondence between the company and the engineer was submitted. Further consideration of the matter has been deferred.

LIGHTING and POWER NOTES.

Atherton.—At a meeting of the District Council held on Wednesday last week a new draft agreement with the Lancashire United Tramways Co. for a supply of electricity was submitted, and subject to certain modifications, it was approved.

Bath.—The B. of T. has decided not to sanction the transfer of the Corporation electrical undertaking to the proposed Bath and District Electric Supply Co.

Barrow-in-Furness.—Messrs. Cands' Furness Foundry and Engineering Works are to be electrically driven from the Corporation mains, which will be extended at a cost of £400. The revenue is estimated at £250-£350 per annum.

Beckenham.—The growing use of metallic-filament lamps has led the Council to consider the advisability of increasing the charge for electricity (at present there is a flat rate of 5d. per unit), owing to reduction in the current consumed. It has, however, decided for the present only to intimate to consumers who have elected to change over to high efficiency lamps, that if in consequence of the introduction of these lamps the revenue is insufficient to enable the Council to carry on the undertaking without loss, the price may be increased. "Free wired" customers are to be allowed to have transformers installed and their premises fitted with high efficiency lamps (the latter at their own cost) on payment of a fixed charge of 2s. per lamp per annum.

A conference has been arranged between the Council's engineer and the South Metropolitan Electric Light and Power Co., at the suggestion of the latter, with a view to arrangements for linking up.

Bermuda.—The Bermuda Electric Light, Power and Traction Co. intends to quadruple the plant it is now employing. This expansion of the company's machinery will enable it to meet all wants in the immediate future. Should the Corporation of Hamilton decide in favour of introducing electricity as the illuminant of the streets a further increase of plant will be necessary. A Committee of the Corporation now has the matter of electric lighting of streets under consideration.—*Royal Gazette.*

Bromley.—It has been laid down as a principle that (house?) transformers are to be installed under conditions which bind the applicant to accept whatever decision the Council come to in the matter of revised charges.

Buncrana (Co. Donegal).—As a result of the new Patents Act, negotiations are now pending between a German manufacturing firm of electrical specialities and some local landowners with a view to establishing works in this locality.

Burnley.—At a recent T.C. meeting, objection was raised, that in spite of the disapproval of the Council, a number of wattmeters for tramway cars had been ordered. The chairman of the Tramways Committee said they had no means of checking the consumption of electricity, for which they paid £14,323 a year, and he agreed with the manager that they ought to have those meters. The chairman of the Electricity Committee stated, in regard to the jealousy which seemed to exist between the two Committees, that he offered on behalf of his Committee, if the Tramways Committee would not spend £250 on wattmeters, to institute duplicate meters.

Continental Notes.—SPAIN.—A twofold project for utilising the water-power in the rivers flowing from the Pyrenees in the Province of Arragon is announced, and application for a concession has already been made by an eminent Spanish engineer, Don Felipe Mora y Ova. One portion of the project is to take advantage of the irregularities of the ground between the Pino and Del Fraile waterfalls on the Caldarea River and to create, by means of a canal 1,787 metres long, an artificial fall of 400 metres, furnishing an estimated power of 8,000 H.P. A further 2,000 H.P. is to be obtained from the Arboala Mayor and Brazato torrents. It is proposed to install in the power house three sets of 3,000-H.P. turbines and alternators, and two sets of 2,000 H.P., one of each group being held in reserve. The second portion of the project proposes to tap the Caldarea at Tanticosa for a further 5,000 H.P. The current generated will be transmitted to a distributing station to be erected at Sabináningo, and will be available for industrial users over a wide area, as well as for the working of a projected railway to the French frontier *viâ* Cauteret and Sallerit.

In an interesting article on the water-power resources of Spain, Senor Carballo, an official of the Telegraph Department, points out, in the *Boletin de la Union Electrica Espanola*, that, while Spain only utilises some 80,000 H.P. from small hydro-electric stations of 100 to 200 H.P. on rivers like the Tajo, the Ebro, the Guadalquivir and others, there is available upwards of 5,000,000 H.P throughout the peninsula. He estimates that the Ebro can furnish 1,130,000 H.P.; the Duero, 900,000 H.P.; the Guadalquivir, 750,000 H.P.; the Tajo, 700,000 H.P.; the Guadina, 370,000 H.P.; the Mino, 250,000 H.P.; the Jucar, 190,000 H.P.; the Segura, 110,000 H.P.; and smaller rivers, 600,000 H.P. The value of this, on the basis of horse-power generated by coal, is 12,000,000 pesetas a day, or 3,600 million pesetas a year. These hydraulic resources, it points out, are vastly superior to those of England and Germany, whose industrial supremacy has been built up on their coal mines, the eventual exhaustion of which will open out a future for lands like Spain, abundantly dowered by Nature with a wealth of hydraulic power.

The first three-phase high-pressure cables, for underground work, manufactured in Spain, have just been turned out by the local firm

of Pirelli y Ca. They are intended for the transmission of electrical energy from the falls of Bolarque to Madrid.

Sweden.—An English company—the Kellner-Partington Co., Ltd.—says *Affarsvarlden*, has bought the majority of the shares in the Forshaga Sulphite Co., the capital of which is 1,800,000 kr. By the previous acquisition of the majority of the shares in the Molnbacka-Trysil, the Fryksfors, the Edsvalla Bruk, and the Degerfors companies, the English company has become the holder of immense forests tracts in Varmland with abundant water-power for the developments of its many interests.

The Government has ordered the new Water Board to institute inquiries as to the possibility of utilising for industrial purposes the waterfalls belonging to the State within the water sheds of the Torne, Kalix, and Lule rivers.

The Trollhätte Kanal och Vattenverk has placed with the Allmänna Svenska Elektriska Aktiebolag in Vasterås the orders for a portion of the transformers and the whole of the instrument equipment for the power station at Trollhättan, and the same manufacturers have received the orders for nearly the whole of the equipment of the great transformer station at Göteborg. The orders total to about 700,000 kr.

Italy.—The Societa Elettrica della Sicilia Orientale has obtained a concession to take water from the Casseble for a hydro-electric station, which will supply energy for the working of electric tramways in Syracuse and its neighbourhood, as well as motive power for industrial users. The plant is designed to supply 5,000 H.P., at an outlay of under 20 million lire.

It has been decided to construct an important electric station at Cape Volturo for the transmission of energy to Naples for industrial purposes. The station will be situated about 90 km. from Naples; a fall of 210 metres will be created on the River Volturno, yielding 16,000 H.P. Estimates place the cost of the scheme at 7,900,000 lire, half of which stands for the hydraulic works and piping, and the other half for the electrical machinery and the transmission lines.

Following in the wake of other Governments, that of Italy is preparing legislation to preserve its water resources. A draft bill has been prepared for presentation to Parliament giving the Government powers to control the mountain springs and lakes which feed the great rivers. Of the possibly utilisable 2,000,000 H.P. possessed by Italy, only about 700,000 H.P. is as yet appropriated in schemes executed or projected.

Germany.—A Berlin company has decided to set up a large central station on the Torfmoor near Ummern, to supply energy for lighting and power purposes to 19 townships in the districts of Celle, Isenhagen, and Gifhorn.

A number of landowners from the Luebeck, Holstein and Mecklenburg districts, have formed a committee, under the auspices of the Luebecker Industrie-Verein, with the purpose of establishing a large central station, which will supply a radius of 25 kilometres.

Switzerland.—The Government authorities of the Canton of Zurich are forming a "company," styled the Elektricitätswerke des Kantons Zurich, whose object is the installing and working of electrical undertakings for the distribution of electrical energy at a cheap rate; also the participation in other undertakings with a similar object. The new company is regarded as an independent State enterprise, which is to be self-supporting; but it is not precluded from obtaining subsidies for the realisation of its schemes, which subsidies must be re-paid out of profits. The outlays for the constitution of the company, and for the construction, working, and upkeep of its various schemes are to be voted by the cantonal Council, from funds lent at interest by the State. The Council will likewise exercise supervision over the company's operations and receive its yearly reports and statements of accounts.

The increase in water-power concessions in a single Swiss canton in the past decade is shown by official figures just published. In 1895 the Valais canton council made its first grant of a fall of 5,000 H.P. to the Viege-Zermatt railway. Two years later the grants totalled 47,500 H.P. In subsequent years these figures were exceeded by 10,000 H.P. to 15,000 H.P. a year, until 1905, when they reached 102,250 H.P. for that year. In the following year they jumped to 136,050 H.P. The grants are all for a period of 100 years.

France.—From statistics recently compiled it appears that while in 1900 the number of French towns lit by electricity totalled 818, as against 1,032 using gas and eight acetylene, in 1908 electricity was used in 2,912 towns, gas in 1,250 and acetylene in 180. The remarkable progress of electricity thus shown is due to the development of long-distance transmissions from hydro-electric works. The latter in 1908, according to the figures supplied by the Union des Syndicats d'Electricité, formed 63 per cent. of the total.

Cork.—At the meeting of the B. of G. last week, a report on the lighting of the Union was submitted, which showed that gas lighting cost over £700 per annum. There were six gas stoves and six 13-burners. Taking the lighting at £680 per annum, it worked out at £1 4s. 7d. per lamp. A motion to advertise for tenders to light the house either by gas or electricity was lost by a majority.

Darwen.—The L.G.B. has sanctioned the borrowing of three sums of £2,960, £460 and £637, for electrical purposes, by the T.C.

Fareham.—The U.D.C. has received from the L.G.B. sanction to a loan of £10,000 for E.L. purposes, £8,350 being for new buildings and generating plant, £450 for public lighting, £450 for engineers' fees, £430 for mains, £220 for house services and transformers, and £100 for meters. The Council expect to realise about £750 by the sale of existing plant.

Friern Barnet.—The local Tradesmen's Association has been informed by the U.D.C. that that body does not propose to take any steps towards the electric lighting of the district.

Haslingden.—The T.C. has decided to apply to the B. of T. for an extension of time for carrying out the E.L. Order, 1899. In the meantime the Council is to be advised by an expert on the question of obtaining electricity in bulk from either Accrington or Rawtenstall, together with a report as to the cost of the Council's own installation.

Hereford.—The T.C. has decided to apply to the L.G.B. for a loan of £8,000 for the following purposes:—Excess expenditure on machinery account, £1,652; ditto on mains account, £648; water-cooling and induced draught plant, £300; services, £1,500; cable extensions, £3,219 10s.; contingencies, £680 10s.

Herne Bay.—The U.D.C. has appointed Messrs. Lacey, Sillar & Leigh, Westminster, to prepare a preliminary report upon the proposed electric light scheme, at a fee of 20 guineas.

Hessle.—The U.D.C. is negotiating with its large neighbour Hull, with a view to obtaining a supply of electricity in the area. The Council has obtained a prov. order for electricity supply, and the Hull Corporation has been asked its terms to take over the order.

Leigh.—From January 1st next the electricity consumed by the several departments of the Corporation is to be charged for at the same rates as are charged to other consumers.

London.—City of London Union.—Mr. Adrian Collins has reported upon the cost and efficiency of the present electric light installation at the offices of the Workhouse, and the work is to be renovated, under Mr. Collins's supervision.

Fulham.—The electrical engineer has been instructed to proceed as soon as possible with the necessary work for alterations to existing brackets and fixing new lamps, at an estimated cost of £43 15s. The work is to be carried out in connection with the conversion of the street lamps from carbon filament to Osram, and for this a tender has been accepted, as reported in another column.

Battersea.—The Electrical Trades Union has asked the Council to consider the advisability of substituting electric light for gas in all its depôts. The consideration of the matter has been adjourned until the annual estimates are brought up.

Woolwich.—Application is to be made to the L.C.C. by the B.C. for sanction to borrow, and for them to advance, £3,820 to cover the two large extensions of mains which have been carried out in Court Road and New Eltham, repayable on the annuity system over a period of 30 years.

Marylebone.—With regard to the proposal by the Electric Light Committee of the B.C. to light certain of the ordinary street lamps within the borough by means of electricity in the place of gas now in use, the Council, at its meeting on December 3rd, decided to accept the offer of the Committee to light the 1,964 lamps in those streets where electric mains are now laid, the existing lamp standards and lanterns being utilised, at a lighting and maintenance cost of £8,650 per annum, compared with £8,818, the amount paid for gas lighting. In the process of conversion, the interest and sinking fund charges on the cost of which are included in the above amount, 1,114 single-burner lamps will be installed, with one 50-C.P. tungsten lamp, 827 double, with two 40-C.P., and 23 triple, with three 40-C.P., which will give an average light 2½ per cent. greater than that now shown by photometric test to be actually obtained from the system at present in vogue.

Southwark.—The Electric Light Committee has been authorised to expend a further sum of £100 in wiring consumers' premises, up to March 31st next. The Committee reported that the scheme has now had a good start, and shows satisfactory results. The amount expended in any of the following years need not exceed the amount annually written off for depreciation, which will keep the actual capital invested in this particular branch of the business at about £1,000.

L.C.C.—At the meeting on Tuesday, the L.C.C. resolved to lend £5,900 to the Hampstead B.C. for transformers and switchgear, mains and house services, and £9,500 to the Stepney B.C. in connection with the erection of a generating station.

City.—A movement is on foot to invite another electric supply company to compete with the two existing suppliers in the City area. It is suggested that the linking-up proposals may end in increased prices. The Corporation has the right to purchase the Charing Cross City undertaking in 1914.

Lowestoft.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £2,000 for additional service outlay for electric lighting.

Maidenhead.—The T.C. has applied to the L.G.B. for a loan of £3,500 for the installation of a 100-KW. direct Diesel engine-driven generator, with switchgear, pump, tanks, &c., and for the extension of the engine room, &c.

Middlesbrough.—As an experiment, the T.C. has decided to light Corporation Road with arc lamps, and the cost will be compared with that of gas illumination. The charge is to be £18 per lamp per annum.

Midhurst.—The Hindhead and District E.L. Co. has informed the R.D.C. that it intends applying for power to supply energy in the parishes of Fernhurst, Linchmere, and North Ambersham. The Council has decided to agree to this on condition that the mains are laid within five years.

Newport (Mon.).—The T.C. has applied to the L.G.B. for a loan of £2,762 for plant at the electricity works; also for £1,500 for meters.

Northwood.—At the last meeting of the U.D.C. a petition, to which were attached 100 signatures, was submitted, stating that the time had arrived when a scheme for public lighting should be adopted.

Oulton Broad.—The U.D.C. has requested the E.L. Committee to considered what steps can be taken to carry into effect the powers now vested in the Council under the prov. order for E.L.

Penmaenmawr.—The B. of T. has recently asked the U.D.C. what steps are being taken to carry out the E.L. order granted some years ago, and it has been decided that the clerk shall report as to the position of the Council and the Power Co. in the matter.

Rawtenstall.—The L.G.B. has forwarded to the T.C. sanction to a loan of £33,800 for the erection of an electricity station, &c.

Rotherham.—The electrical engineer to the T.C. is to prepare a report as to the cost of extending the cables to Wincobank, the probable revenue to be derived by so doing, and the financial result of supplying energy to persons in that district direct from the generating station, also the cost of erecting a plant in that part of the borough with the estimated revenue and financial result.

South Africa.—Uitenhage (Cape Colony).—The T.C. has provisionally accepted the electric lighting scheme of the General Electric Co., of London. The matter has still to be submitted to the ratepayers for approval.

Sowerby Bridge.—It was announced at a meeting of the U.D.C. on December 2nd that the Yorkshire Electrical Distribution Co. would be in a position to take up the Council's E.L. order early next year.

Spalding.—The B. of T. has informed the U.D.C. that the question of revoking the E.L. order will be deferred for another year, but if nothing has been done at the end of that period to carry out the proposed works, the order will be revoked without further notice.

Swansea.—The E.L. and Tramways Committee of the T.C. has decided to pay ¼d. instead of ½d. per unit for electricity generated by the Streets Committee at the refuse destructor.

Walmer.—Replying to the request of the B. of T. for information as to what had been done to carry out the E.L. order, the U.D.C. has stated that owing to the present depression it had not been found practicable to carry out the scheme. The Council asked for the order to remain in force another year.

West Ham.—As the existing contracts with the gas companies for street lighting will shortly expire, the Electrical Committee is to be authorised to submit an estimate in competition with the gas companies. A special agreement has been concluded by the electrical engineer with Messrs. H. Tate & Son, Ltd., of Silvertown, for the supply of energy for five years. The Electrical Committee has again had under consideration the matter of the L.G.B. inquiry which was adjourned by the Inspector (Mr. Hooper) because the representatives of the Council declined to give information as to the terms on which it supplied energy to certain large power consumers. The Committee has decided that the Council still decline to produce the contracts, and has authorised the town clerk to take such steps as he considers necessary to protect the Council's interests.

Yarmouth.—The T.C. has received the sanction of the L.G.B. to the borrowing of £2,000 for additional mains for the electricity undertaking.

TRAMWAY and RAILWAY NOTES.

Birmingham.—The B. of T. is to be asked to sanction the borrowing by the T.C. of £92,047 for the reconstruction and construction of tramways; £35,353 is for street widenings.

British Guiana.—The *Demerara Argosy* of November 13th states that Messrs. E. R. Davson and E. G. Braddon are negotiating with the British Guiana Government for the opening up of the Essequibo District by the construction of railways and other means of transport.

Burnley.—The Tramways Committee has agreed upon draft clauses to be inserted in an order which the promoters of the Blackburn, Whalley and Padiham Light Railway Order, 1901, are promoting to revive powers. These clauses provide that Padiham Council may, within six months from the expiration of the Corporation's lease of tramways in the Padiham district, give notice requiring the light railway company to sell to it that portion of the undertaking within the district. At a meeting of the Council last week, the town clerk said the altered clauses prejudicially affected Burnley, and the Town Council has decided to appeal to the Commissioners.

Continental Notes.—Hungary.—According to a recent statement of the Hungarian Minister of Commerce, it is intended to carry out the electrification of the whole of the existing tramway system of Buda Pest, in the course of the coming year.

France.—The Compagnie des Tramways de Tours proposes to electrify the tramway lines radiating from this town to Luynes, Fondettes and Vouvray, and to lay a new line to Pont-Cher. For this purpose it has applied to the department for advances, totalling 1,130,000 fr., and a subvention of 30,000 fr., the latter to be paid jointly by the Communal Councils of Tours and Joué.

The Paris Metropolitan Railway provides excitement of an unusual kind. Recently a fox escaped from the Zoological Gardens, and took refuge in one of the Metropolitan stations; 10 dogs which joined in the chase got upon the track, seven of them being electrocuted before the fox could be captured.

The 20-H.P. Balachowsky-Caire petrol-electric motor-car which was described in the Electrical Review about a year ago, recently made a successful journey from Paris to Milan, an average speed of about 25 miles per hour being maintained.

Italy.—The extensive railway concession which the Società Tranvia Vicentile has in hand, comprising six lines of a total length of 139·6 km., and estimated to cost 2,890,811 lire, is now in a fair way of realisation, the Provincial Council having consented to grant the subsidies asked for. The network is to be completed sectionally within a period of seven years.

Sicily.—La Societa Elettrica delle Sicilia Orientale has secured a concession to put down a plant to utilise the water-power of the River Cassebile in the generation of electrical energy for the operation of the tramways in Siracusa.

Conway.—A letter was read at a recent Council meeting, in which the Llandudno and District Electric Construction Co. expressed its inability to make any statement with regard to the extension of the electric tramway from Llandudno West Shore to Deganwy. The opinion was expressed by members that it was unfair of the company to delay the construction of that part of the line, taking into consideration that the T.C. had, from the very beginning of the scheme, refrained from putting any obstacle in the way of the different companies. Eventually the matter was deferred with a view to seeing what pressure could be brought to bear on the company to carry out its obligation.

Glasgow.—Opposition has been raised to the T.C.'s proposal to lay tramways along University Avenue, by owners and occupiers of property there, and by the University Court. The objections by the latter body are unique, and point out that the running of cars along the Avenue would seriously interfere with research and other work in laboratories. At a sub-Committee meeting a proposal was adopted asking the tramways manager to obtain from other towns where similar circumstances may exist, information as to (*a*) the alleged detriment to magnetic instruments and research work in laboratories from vibration caused by passing vehicles and from the current in tramway electrical equipment, and (*b*) any devices or precautions which have been adopted to obviate or minimise the same. The present Committee has, however, decided to recommend a rescinding of the Parliamentary powers obtained for the extension, and a special meeting of the T.C. will be held to discuss the whole matter.

The T.C.'s Sub-Committee on the Local Government Scotland Bill has decided to recommend (*a*) that the Corporation do not press for the inclusion of the proposals in the Bill, and (*b*) that it be remitted to the Parliamentary Bills Committee to endeavour to get the Government, or a member of Parliament, to introduce a Bill amending the law as to the method of the valuation of gas, water, tramway, and electric light undertakings, and giving effect to the recommendations of the Royal Commission which reported in 1902, viz.:—That in rural areas, underground gas and water piping, and underground works connected with such undertakings, should only be assessed on one-fourth of the annual value thereof, and further, that tramway lines, and the underground works of electric light undertakings, be similarly treated.

Haslingden.—Mr. Handcock (Messrs. Handcock and Dykes) has been instructed by the Council to interview the Accrington and Rawtenstall Councils respecting the present and future supply of electricity for tramway purposes, and to embody their replies in a special report, which will also contain an estimate of the cost of the Haslingden Corporation generating its own electricity, having regard to the new destructor works.

Heston and Isleworth.—Proposals for establishing a line of communication between Southall and Twickenham, by way of Heston, Hounslow and Whitton, have been before a conference of the authorities and these centres. A system of communication linking up Hounslow and Isleworth with St. Margaret's and Richmond is also mooted. The scheme under discussion is an electric tramway or light railway worked by power from the Heston and Isleworth and the Twickenham electrical undertakings.

Heywood.—A special meeting of the T.C. was called for yesterday (Thursday) to authorise application to be made for a Parliamentary Bill to give authority to the Corporation to enlarge its tramway powers so as to enable it to run its cars over the tramways of the Bury and Rochdale Corporations, and to confer other powers in respect to the electricity undertaking.

Hounslow.—A conference of the local authorities whose districts are served by the London United Tramways, has been held, regarding the condition of the tramway track in their respective districts, and has been adjourned until Monday next (Dec. 14th)

when Sir J. Clifton Robinson, the managing director of the company, who has been invited to attend, will, it is hoped, be present.

Hove.—The promoters of the Hove tramways have decided not to proceed with their scheme for the present. It was originally intended to electrify the old Shoreham horse route and to connect it with the Brighton system, but various alterations in route are now proposed.

London.—L.C.C.—At a recent meeting of the L.C.C., Mr. Shirley Benn mentioned Sir John Benn's speech at Mile End on December 7th, when reference was made to the Aldgate-Bow surface-contact system, the speaker stating that people had been injured, horses roasted, &c. Mr. Shirley Benn pointed out that no claims for compensation had been received by the Council in respect of such occurrences, and the statements were absolutely misleading.

According to the daily Press, the agreement arrived at by the London Traffic Conference will shortly terminate. The various tube railway authorities blame the 'bus companies, the latter having reduced their fares a few days ago; the 'bus companies, on the other hand, point out that the railways first violated the agreement by issuing books of tickets at reduced rates.

The Central London directors are stated to favour the introduction of penny fares, and doubtless the various other railway companies affected will have to face reduced fares again.

It is stated that the Central London and G.N. and Piccadilly tubes are to be linked together, as between the British Museum and Holborn stations, by means of a travelling platform. This would get over the difficulties due to the relative position of the two stations, which are 130 yards apart and one 70 ft. below the other.

Northampton.—The Tramways Committee has recommended the T.C. to extend the tramways in the borough at a cost of £9,015.

Oldham.—At the monthly meeting of the B.C. last week, the work of the Electricity and Tramways Committee came in for some criticism. Alderman Lees stated that the initial cost of the tramways was from 15 to 20 per cent. too high, and that the Council should devote its energies to building up a reserve fund of at least £50,000. Others expressed the same opinion, whilst far from believing that the undertaking was going to the dogs. It was also argued that, as the ratepayers had to make up losses, if any, they should have a fair share of the profits. The chairman of the Committee, Alderman Dunkerley, said the Finance Committee held £29,000 of the tramways sinking fund, interest on which ought to be credited to the tramways account. The Committee could run the tramways at a profit if it had fair play. The assessment of the undertaking ought to be reduced by at least £3,000. No resolution was submitted on the subject.

Sandgate.—A meeting of the General Purposes Committee was held last week, to interview Mr. Cownie, of the National Electric Construction Co., in reference to local tramway matters, the company's new proposals being explained at length.

South Africa.—PORT ELIZABETH.—In the course of a recent flood the electric tramway service was completely disorganised. The water flooded the power station to a depth of 7 ft. 6 in., generators and engines being covered. When the water commenced to rise, cars not in in use the sheds were taken out in fear of the shed collapsing. The water swirled round these so fiercely that one heavy car was overturned, and carried 18 ft. away from the track. Mr. J. A. Barkly, the manager of the tramway company, had a narrow escape. He was in the power station, and noticing the water rise so rapidly he went out to investigate. Seeing the state of affairs, he rushed back to call the men out, and on returning he found 6 ft. of water running past. Fortunately help was at hand, and he was assisted out of his predicament. Four men on duty had to swim for their lives. One man lost his presence of mind and wanted to get on the top of the boilers, and the others had a most difficult task to get him out. During the whole afternoon the back car-shed, facing the river, was greatly out of perpendicular, only being held up by wires. Shortly after six o'clock it fell into the river with a loud splash. Other portions of the building cracked and threatened to collapse. The municipality has offered to supply power to carry on the tramway service.

Torquay.—At a recent meeting of the T.C., Mr. W. B. Cownie wrote with reference to the proposed extension of the tramways to Paignton, asking for the Corporation's consent to the extension to the tramway within its area, and stating that the extension would be on the overhead system; the period for concession should be 42 years. The application would be made by the Torquay Tramways Co., in whom the present tramways would shortly be vested, but the Corporation's expenses would be guaranteed by his company. A plan was sent showing the amount of single and double line it was proposed to construct. Mr. Cownie and Mr. Willis, the engineer of the company, subsequently attended on behalf of the tramway company, and produced plans of the proposed tramway route from the present terminus at Torquay station to Paignton station, a distance of about 2½ miles, of which one mile or thereabouts was in the borough. The matter was discussed at considerable length, it being decided to agree in principle to the application, subject to the approval of details, one of which would be the system. Opposition was offered to the proposed overhead system, Mr. Young contending that it was the thin edge of the wedge. Once started, the company would want the same system applied to Torquay. The report was adopted.

Yarmouth.—At a meeting of the T.C., a suggestion to extend the tramways for the convenience of those engaged in the fishing was not entertained. The surveyor estimated the cost at £2,000, of which sum £400, he said, would be spent in labour.

TELEGRAPH and TELEPHONE NOTES.

Austria.—The Post Office authorities intend to expend a quarter of a million sterling next year on the development of the telephone service. New trunk lines will be provided between Vienna and Berlin and Frankfort, the existing lines being quite inadequate to carry the traffic. The new lines will enable Vienna and Trieste to speak direct to Hamburg. In Vienna provision is to be made for 110,000 subscribers—five times as many as at present.

British Guiana.—For the year 1907-8 there were 439 subscribers to the telephone system, being an increase of 28 over the previous year. The revenue from the telegraph system increased during the year, but the increase was more than counterbalanced by an increase in the working expenses owing to special expenditure.

China.—A factory is to be established by the Government at Tientsin for the manufacture of all the material which is likely to be required for extensions of the telegraph system, which, when carried out, will add to the length of it some 10,000 miles. In 1906 the Imperial Chinese Telegraph Co. owned 22,419 miles of line with 34,473 miles of wire, a submarine cable 946 miles in length, and 379 offices. The number of instruments was 768. At the head office, at Shanghai, the staff numbered 67, and the general staff 3,175, while inspectors, &c., brought the number to 3,400.

Glasgow.—A sub-Committee of the T.C.'s Special Committee on Telephones has been appointed to confer with the Postmaster-General on the lines of the following question, referring to the Corporation's late telephone department:—"Whether one of the prime conditions of the transfer of the telephones to the Post Office was that existing contracts with present subscribers should be maintained till 1911; was he aware that the Post Office now demanded a guinea extra for the continuance of the Exchange extension lines in the telephone directory; and was such not a departure from the agreement or understanding?"

India.—In answer to Sir E. Sassoon, according to the *Times*, Mr. Buchanan recently stated that it would be necessary to obtain the consent of all the partners in the Indian Joint Purse Agreement before the express terms on which the Eastern and South African Telegraph Co. became a partner in this joint purse could be made public. The opening of the Australia to Africa cable had diminished the volume of traffic yielding a transit tax to India; the loss for the official year 1907-8 was estimated to have been about £23,000. The opening of the Batavia-Cocos cable in April last allowed of the diversion of traffic from and to the Dutch Indies. A telegraph landline from Teheran, *via* Kerman, Robat, and Indian Baluchistan to Karachi, was opened for traffic in November, 1907, as an alternative and additional line to the one from Teheran, *via* Bushire and the Persian Gulf, to Karachi. The cost of a message sent from Calais to Rangoon, which passed over either of these lines, was 2.50 fr. per word. According to Table B of the International Telegraph Convention, the terminal tax per word on such a message would be 0.15 fr. for France and 0.35 fr. for India. The transit taxes payable would be 0.20 fr. for Germany, 1.13 fr. for Russia, 0.44 fr. for Persia, and 0·68 fr. for the Persian Gulf. The total of these conventional rates would amount to 2.95 fr. The lower through rate accepted of 2.50 fr. per word had been brought about by arrangement between the Administrations concerned.

Italy.—Experiments have recently been made to communicate by telephone between Palermo and Milan. The circuit consists of a 5-mm. bronze wire between Palermo and Rome, and a 4-mm. wire between Rome and Milan. The results have been much more satisfactory than when conducted with the old circuit of 3-mm. wire; the latter will, therefore, be reserved for short-distance calls and local work.

New Telegraph Offices.—The African Direct Telegraph Co. announce the permanent closing of the telegraph office at Leckie, Northern Nigeria, and the opening of new offices at Epe, Akodo and Udi, in Southern Nigeria. The Great Northern Telegraph Co. also state that the Chinese Telegraph Administration notifies the opening to international service of telegraph offices at Ihing, in Kiangsu, and at Kiamoze, in Kirin.

Telegraphic Interruptions and Repairs:—

CABLES.	INTERRUPTED.	REPAIRED.
Port Arthur-Chifu	Mar. 9, 1904	..
Pontianak-Saigon	Sept. 16, 1908	..
Dakar-Conakry	Nov. 6, 1908	..
Cotonou-Grand Bassam	Oct. 29, 1908	Dec. 5, 1908

Uruguay.—The Government is contemplating the working of telephone services in Monte Video and the various Departments.—*Board of Trade Journal.*

(*Continued on page* 1015.)

THE MANCHESTER ROYAL INFIRMARY INSTALLATION.

Among the features of modern Manchester, few are more striking architecturally than the new Royal Infirmary which faces the Whitworth Park and replaces the grim old building in the centre of the city, in Piccadilly. The new infirmary with its 48 separate buildings is striking, not only in outline, but also in regard to the close study which has been bestowed on the thousand and one details of its equipment; the electrical equipment, in particular, has been carried out on a lavish scale.

The electric supply is obtained from the Manchester Corporation electricity department, two independent three-wire supplies being brought in from the Dickinson Street and Stuart Street generating stations, respectively. These enter the infirmary premises in Nelson Street, and are carried through a subway to the basement of the casualty block, where the main switchboard is installed. In passing, it may be mentioned that the separate blocks of buildings are connected by covered corridors, and that under those on the ground floor, roomy subways have been constructed, where all the electrical cables, steam, hot and cold water and gas pipes are installed. Some 36 feeders traverse these subways, being carried on C.I. brackets which are fitted to the roof joists, and so arranged that any single cable can be removed without disturbing the remainder.

The New Royal Infirmary, facing Oxford Road, Manchester.

The entering Corporation cables pass on to a terminal board fitted with 1,000 ampere circuit-breakers in the outers and fuses in the neutrals, and thence to an enamelled slate switchboard, supplied by Messrs. Bertram Thomas & Co. This board, which controls the whole of the sub-supplies throughout the buildings, contains four centre panels carrying four main single-pole, 1,000 ampere switches and fuses, also upper and lower feeder panels on either side, fitted with D.P. throw-over switches and fuses. In addition to the main supply, the whole of the local feeders are duplicated, and the board is so arranged that any feeder can be thrown on to either supply. The upper and lower feeder switches are interlinked for obvious reasons, and in addition to the usual instruments, red lamp indicators are provided to draw attention to the state of the connections at any particular time.

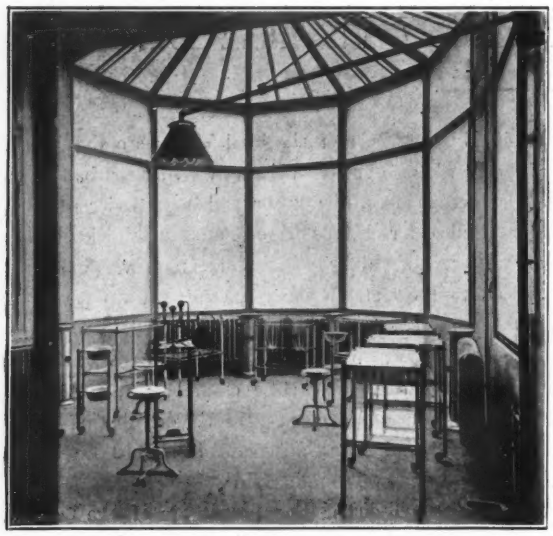
The feeders, which are of the armoured lead-covered paper-insulated type, supply 14 section boards, from which armoured rubber cables connect to the distribution boards and fuseboards fed from the latter. In all 112 fuseboards with 700 D.P. fuse-ways are installed.

All the fuse and distribution boards are of the Ediswan "Insurance" type, with enamelled slate bases and teak casing, and by a neat arrangement all the boards are hinged, so that after fixing they can be connected up without disturbing the insulators. This arrangement has been generally commended.

The ward lighting has been admirably carried out; the duplicate service is so arranged that in any building the first and second wards are on the positive side, and the third and fourth wards are on the negative side of the supply system, thus ensuring that not more than 200 volts pressure shall exist on either service, and giving a balance as regards the Corporation mains. Three rows of lamps are provided in each ward, the centre row being supplied from one station and the two outer rows from the other; in the ward above this arrangement is reversed as regards the sources of supply, and similarly throughout.

Should a breakdown occur, the whole of the ward lighting can be thrown on to one source of supply.

A light is provided for each bed, controlled by a local switch fitting, which also carries a 10-ampere plug fitting



An Operating Theatre, with Swinging-Bracket Lamps.

arranged for supplying canteries, sterilisers, and electro-medical apparatus generally.

All the pendants are of plain tube, white enamelled, with swing joints. One light in the centre row is fitted with a reversible shade, which is used at night to illuminate the ward by reflected light, the other lamps being extinguished. This, of course, obviates the inconvenience of light shining into the eyes of the patients.

Each circuit is controlled by a master switch at the entrance to each ward, by which means only the nurse in charge can control the lighting; each ward is also ventilated by two motor-driven Sirocco fans.

The laundry wiring is all lead covered, run on porcelain cleats fixed 18 in. apart; watertight tube fittings and switches are used.

All stores and hot rooms, where dry heat is experienced, are provided with asbestos-covered wiring, run in wood casing; this also applies to the Turkish baths.

The lighting of the chapel and lecture theatres has received special treatment. The chapel has 10 six-light bronze fittings, each provided with a white enamelled parabolic reflector, inside which are five 50-c.p. Osram lamps, while an Osram pilot lamp is provided on the underside. The altar is lighted by 15 Osram lamps arranged behind a cornice, which at night give a soft diffused light.

In the lecture theatres, and post mortem theatres, the same design of fitting has been used; and for lighting the blackboards a special balance-weight fitting with a horizontal tube, carrying three Linolite lamps, has been installed, which gives a perfect lighting for this purpose.

In the operating theatres, the centre of the operating table is illuminated by a special six-light fitting, enclosing six Osram lamps under a white opal shade, 20 in. dia. × 15 in. deep. Alternate lamps are wired on the duplicate supply, with special throw-over switches, fixed locally, to ensure perfect safety during operations. The lamp-holders have smooth outer dust-proof cases, and rubber rings over the lamp caps to make them, in addition, watertight. The operating theatres are wired in hard-drawn heavy-gauge copper tubing, nickel plated and polished; all fitting bases are bracket boxes; the switch and plug boxes are all of gun-metal, also nickel plated and polished.

A special low-pressure lighting service is provided for the operating theatres with a view to safeguarding the illumination during operations and rendering it independent of outside sources of supply.

A motor-generator by the Lancashire Dynamo and Motor Co. (400/16-25 volts) is installed in the main switch room, for charging an 8-cell 250 ampere-hour E.P.S. battery in an adjoining room, the motor-generator and battery switchgear being in the main switch room, also a L.T. switchboard by the G.E.C. and a section board.

A special 19/16 feeder runs from this point to each of the eight operating theatres, terminating in each case in a 25-ampere D.P. switch; on the left of the operating table a 5-ampere S.P. switch, also 5-ampere and 25-ampere wall plugs are provided—the 5-ampere plug for the surgeon's head light and the 25-ampere plug for surgical work.

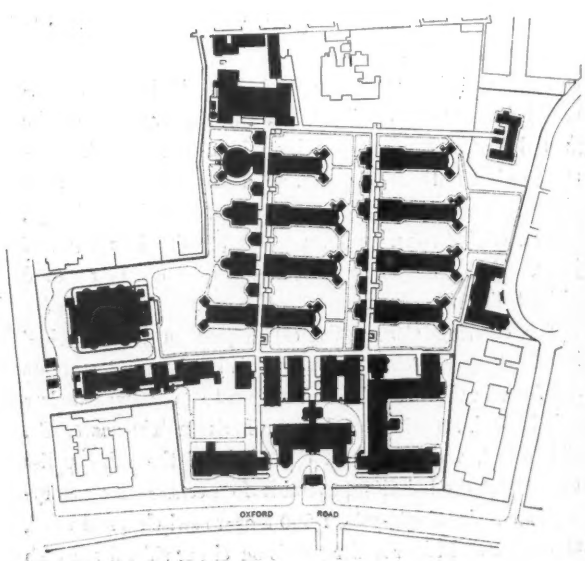
All the special fittings for the operating theatres, &c., have been designed and made by Messrs. F. Adams & Co., of Salford.

The ventilation of all the buildings is by means of ducts in the ceilings, which are coupled to electrically-driven Sirocco exhausting fans on the roofs.

These fans are mostly of the vertical spindle type with footstep bearings; the whole of the 38 fans installed are of the Sirocco type, coupled to motors by Electromotors, Ltd.

The buildings are equipped throughout with the Magneta Co.'s electric time system. Between 70 and 80 dials have been provided and divided into two circuits, wired in series-parallel, and under the control of a

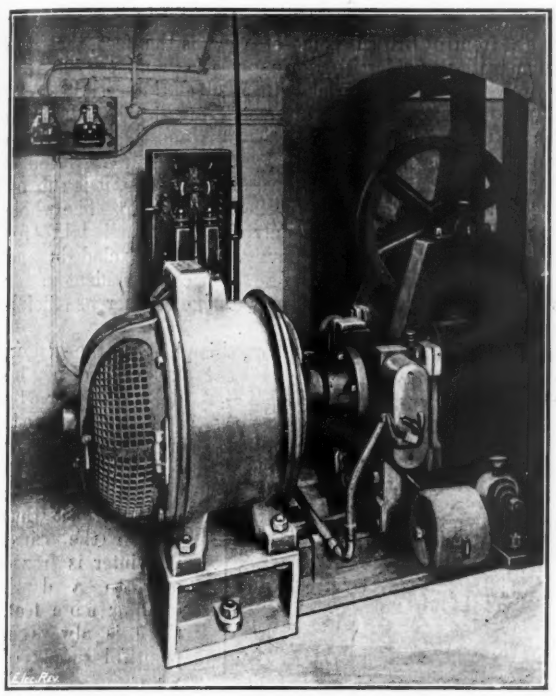
Interior of Chapel, with Special 6-light Bronze Fittings.



Block Plan of Infirmary Buildings.

master clock in the general office. Some idea of the extent of the infirmary may be formed from the fact that the wiring in series took over 3½ miles of wire to complete the two circuits.

The National Telephone Co. has installed over 70 instruments in the various buildings, wired back to a 100-line common-battery board. A perfect system of telephonic communication is obtained with all parts of the institute, and from every part of the buildings an outside subscriber can obtain either local or trunk calls. There is also installed a private telephone service by means of which the general superintendent can speak direct to any official on the staff; a system of indicators is also installed for the use of the staff, a doctor on entering or leaving the administration block registers himself "in" or "out"—this being automatically repeated at all the important buildings for the information of those concerned.



Motor and Control Gear for Bed Lift.

In addition to the foregoing there are numerous motor applications which we can only mention. These include an electrically-driven refrigerating plant for the kitchen department and mortuary block. The kitchens—arranged to cook for 1,000 patients and the staff—are provided with steam and gas cooking ranges, but all the subsidiary machinery for knife and fork cleaning, washing, ventilating, &c., and the hoists, are electrically operated.

Fifteen electric lifts for passengers, goods, beds, &c., with Congden & Muir control are provided—the motors being by Mather & Platt.

One of the features of this installation is that the whole of the work has been carried out to schedule, and all materials have been measured up and reported daily, on a special sheet provided for the purpose, so that the consulting engineers could follow the work daily. Wood casing has been used in all parts of the buildings, except subways and exteriors; the casing and covering are of special design, quite plain, with a semi-cylindrical exterior. There is no grouping of wires, and only one size of casing has been allowed in one room.

Multiple grooved casing as large as 22 grooves, has been used; all corners have been turned by special bends grooved to meet the casing, and no horizontal fixing has been allowed. The length of single-grooved casing is over 64 miles; the pattresses, switch blocks, &c., have been specially designed to meet hospital requirements, and over 75 miles of 3/20, and 7/20 wire has been used in wiring for electric lighting, plugs, and fans; over 11,000 yards of armoured cables, weighing approximately 170 tons, being used for the local feeders.

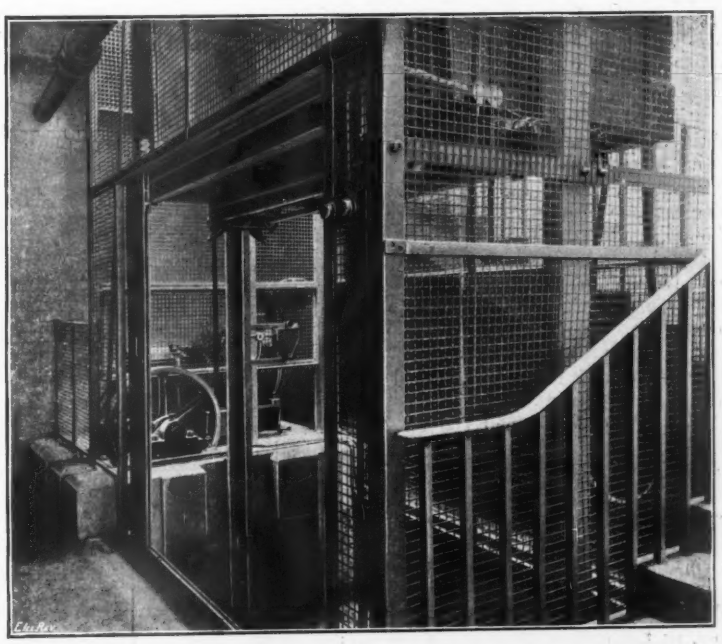
In conclusion, Messrs. Miller, Wilson & Pegg have acted as consulting engineers in connection with the electrical work; Messrs. Lightfoot Bros. (Manchester) being wiring contractors for the whole of the installation, for which Mr. F. Wilde has acted as electrical clerk-of-works since the commencement.

The following firms have also been concerned in the work:—

Lifts.—Higginbottom & Mannock.
Control switches for motors, battery, &c.—Brook, Hirst & Co.
Hospital pendants, conduit, lamps, &c.—General Electric Co.
Lamps; section, distribution and fuseboards, &c.—Edison and Swan United Electric Light Co.
Fittings for nurses' home, administration and teaching blocks; special reflector light fittings and outside brackets.—Veritys, Ltd., and Singer & Sons.
Special fittings for operating theatres.—F. Adams & Co.
Special resistances for electro-surgical work.—H. O. Farrell & Co.
Ironclad main switches and circuit-breakers, 12½ to 75 amperes.—Dorman & Smith.

THE MUNICIPAL HYDRO-ELECTRIC PLANT AT MORRISBURG, ONTARIO.

Our note (Elec. Rev., Nov. 27th, p. 925) on the power installation at the Canada Tin Plate and Sheet Steel Co.'s Factory at Morrisburg, Canada, may be supplemented by a brief description of the unique hydro-electric plant from which the Tin Plate Co.'s supply is taken.

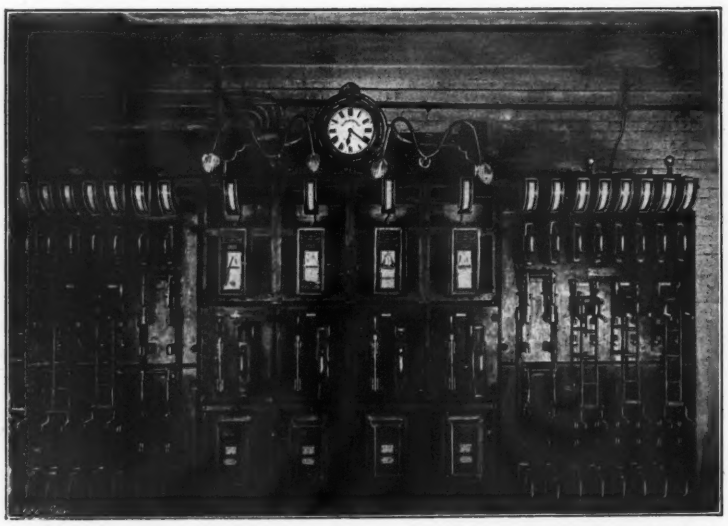


View Showing Drive and Bed Lift Enclosure, Manchester Royal Infirmary.

On the St. Lawrence River, above Montreal, there are a number of canals which have been built to aid navigation up

A Pipe and Cable Subway; Manchester Royal Infirmary.

the river as far as Toronto, and beyond — the numerous "rapids" preventing vessels from travelling up the stream. On one of these canals, which commences at Morrisburg, there are no less than three hydraulic plants owned by the Corporation of the village of Morrisburg — one being used as a pumping station to supply the town with water, and two for supplying energy for lighting and factory purposes.



Main Switchboard Controlling Duplicate Supply and Local Feeders; Manchester Royal Infirmary.

It is with the newer of the two latter plants that the present notes are concerned. The older of the two has been in operation some nine or ten years, and is used principally for lighting.

The newer and larger plant was installed by Wm. Bermingham, of Kingston, Ontario (the sub-contractors being the Wm. Kennedy Co., of Owen Sound, for the water turbines, and the Canadian General Electric Co., Toronto, for the electrical apparatus) and has been in operation for about 13 months.

At this part of the canal the average head of water is about 10 ft. The canal skirts the river all the way, and the entrance is through two locks. Thus the head race of the power house is the canal itself and the discharge is direct into the river.

There is a generator of 1,100 kw. (2,200 volts pressure), which is connected by gearing to four horizontal type water turbines, two being abreast on each side of the generator. The efficiency of the "wheels" is obviously very low, but as there is always, even in the winter, plenty of water, this fact does not "cut much ice," as our Canadian cousins say.

The governor is connected to the main generator shaft by belting, and is so designed that it will completely open—or close, as the case may be—the gates in 8 seconds. This operation is comparatively slow, but the volume of water to be checked renders quicker opening or closing of the gates unsatisfactory.

When the 750-h.p. motors at the Tin Plate Co.'s factory are started up, the speed of the generator is lowered considerably, momentarily; but the starting up or shutting down these large motors is not a daily practice, as there are three shifts of tin-plate workers at the factory, and thus the motors are run continuously.

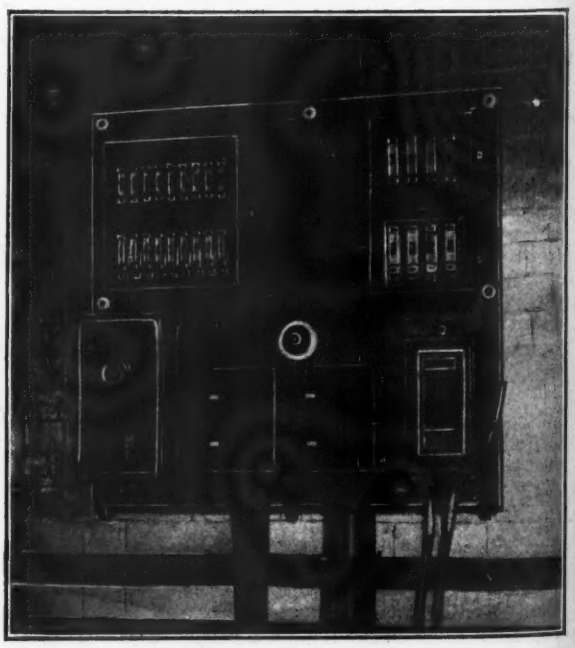
The switchgear is extremely simple, the generator being connected through an oil switch direct to the transmission line.

The factory is about a mile from the power house, and power is transmitted on overhead bare copper conductors.

Perhaps the most interesting feature about this particular plant, from a British point of view, is the fact that the Municipality of Morrisburg supply power up to 700 h.p. entirely free to the Canada Tin Plate and Sheet Steel Co. This concession was made to the company because it brought the tin plate industry into Morrisburg; and the only cost to the company is that of operation and maintenance. Although the plant is owned by the town of Morrisburg, it is run by engineers engaged and paid by the Tin Plate Co. The whole power house staff numbers only four men, all told—for continual night and day running, Sundays excluded; and this fact will probably interest a recent correspondent in our columns who mentions a power plant whose numerous officials apparently get in each other's way.

Other interesting points about this plant are the exciter, which can be driven either by its own small water wheel or from the main generator shaft; and the fact that though the canal in winter is frozen over to a depth of 2 or more feet, there is always a plentiful supply of water.

It may, perhaps, be as well to mention that in January this year, the Tin Plate Co.'s Factory was almost totally destroyed by fire, and it speaks well for the responsible officials that the plant is again in operation.



Distribution Terminal for Operating Theatres; Manchester Royal Infirmary.

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TELEGRAPH and TELEPHONE NOTES.

(*Continued from page* 1010.)

Wire Theft.—At Glasgow a man named William Read has been sentenced to six months' imprisonment for cutting down and stealing seven miles of telegraph and telephone wires, whereby the block system on the railway was dislocated.

Wireless Telegraphy.—The daily Press states that the first wireless telegraph station to be owned and controlled by the General Post Office has now been completed by the Marconi Co. at Bolt Head, near Kingsbridge, South Devon. The station will have a range of about 100 miles. The work was begun about six months ago, and it is estimated to cost about £10,000. The instruments are a combination of the Marconi and patents owned by the G.P.O. It is stated that the station will be opened for public messages in the first week in January.

The German Government has decided to construct two new stations for wireless telegraphy, at Cologne and at Königsberg, either of which will be able to communicate with Göttingen, which will very shortly be finished.

The Spanish Government is just completing four new wireless telegraph stations—one at Almeria, on the coast of the Mediterranean, about 420 km. from Granada, to communicate with another situated at Melilla, on the coast of Morocco, 200 km. distant. The other two stations are at Chamartin and Guadalajaca, in Castilia, the distance between them being 50 km.

"Writing by Telephone."—The Telewriter Syndicate has recently been demonstrating the commercial capabilities of the Telewriter, an instrument based upon the Telautograph, but greatly improved. The Postmaster-General has granted a licence to the syndicate, and on Friday last a trial took place at the General Post Office through a telephone circuit 40 miles long, with successful results.

CONTRACTS OPEN and CLOSED.

OPEN.

Algeria.—January 15th. Tenders are invited by the Bône municipal authorities for—(1) the construction and working of a central electric power station, and (2) the construction and working of an electric tramway. Copies of the projects, specifications, &c. (in French), may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Australia. — QUEENSLAND. — January 4th and 11th, 1909. Tenders are required by the Postmaster-General for:—No. 1, telegraph instruments, accessories and spare parts; No. 2, telephone instruments, accessories and spare parts; No. 3, switchboards, accessories and spare parts; No. 4, measuring instruments, protectors, accumulators and parts. Tenders for the foregoing by January 11th, 1909; and for cables, copper wire, iron wire and insulators, by January 4th, 1909.

SYDNEY, N.S.W.—April 28th, 1909. The Postmaster-General requires tenders for the supply, erection, &c., of a branching metallic multiple magneto switchboard at the William Street telephone exchange, according to specification No. 236.

SYDNEY.—February 22nd. Five water-tube boilers, economisers, stokers, feed pumps, pipework, &c., for the Council's electricity department. See "Official Notices" to-day.

Austria.—TRIESTE.—January 5th. The San Andreea dock authorities require tenders for 12 movable electric cranes. The Technische Abtheilung der Lagerhausverwaltung will deliver specifications at cost price.

Battersea.—December 22nd. Coal for the electricity department. See "Official Notices" December 4th.

Belgium.—BRUSSELS.—January 8th. The Palais de Cinquantenaire electric lighting installation is to be adjudicated on January 8th, 1909; a deposit of £18 is required. Specifications No. 89 may be obtained for 3d. and plans for 4s. 2d., at 15, Rue des Augustins.

BELGRADE.—December 25th. Tenders are required for 3,000 elements for telegraph batteries, 1,000 zinc and 1,000 copper poles, by the State Railways. A deposit is required, and samples may be inspected at the railway station.

Bradford.—December 23rd. Two 3,000-KW. turbo-generators complete with condensing plants, motor-driven auxiliaries and piping for the Corporation. See "Official Notices" to-day.

Birmingham.—The Corporation Electricity Department will be glad to hear from firms capable of building large gas engines and producer gas plants. See "Official Notices" November 20th.

December 29th.—Electric motors for the Corporation Supply Department. See "Official Notices" December 4th.

Canada.—WINNIPEG.—December 28th. A *Financial Times* dispatch from Winnipeg says that the municipality on Nov. 24th resolved to invite tenders, to be delivered by December 28th, for extensive power plant, the cost of which is stated at more than £1,000,000.

Cardiff.—December 18th. One 2,500-K.V.A. turbo-alternator, complete with surface-condensing plant and motor-driven auxiliaries, for the Corporation. See "Official Notices" December 4th.

December 12th.—The Corporation is inviting tenders for 30,000 tons of coal for the electric lighting and tramways department. Tenders to J. L. Wheatley, Town Clerk.

Felixstowe and Walton.—December 12th. Diesel oil engine and dynamo for the U.D.C. See "Official Notices" November 27th.

Germany.—Tenders are shortly to be invited by the municipal authorities of Burgstadt (Rendsburg) for the establishment of a central electric lighting station in the town.

The municipal authorities of Barmen are about to invite tenders for the construction and working of an electric tramway between Barmen, Hasslinghausen and Hiddinghausen.

Glasgow.—Electrical fittings for a year for Wm. Barr and Sons, Coalmasters, Ltd. Thos. H. Barr, Managing Director, 10, Bothwell Street, Glasgow.

Graigola.—December 20th. Electrical goods for six months. Graigola Merthyr Co., Ltd., Cambrian Place, Swansea.

Hackney.—December 17th. D.C. electricity meters, of the ampere-hour motor type, for the electricity department. See "Official Notices" November 13th.

Kilmarnock.—The Corporation invites tenders for the electric lighting of the infectious diseases hospital; conditions from the electricity works; tenders to W. Middlemas, Town Clerk.

Manchester.—December 18th. Foundation work for a 6,000-KW. turbo-generator set, pipe trench, and extensions to air filter house, required at Stuart Street generating station. Particulars from Secretary to the electricity department.

Russia.—ST. PETERSBURG.—December 21st. The administration of the municipal telephone service, Morskaja 22, requires tenders for lead-covered, paper-insulated telephone cables.

BAKU.—January 24th. The T.C. is inviting tenders for its electric tramway concession (42 years). Full particulars at the Russian Consulate in London.

Selby.—Battery of accumulators at the waterworks for the U.D.C. Bruce McGregor Gray, Waterworks Engineer, Selby.

Spain.—MADRID.—December 21st. The municipal authorities require tenders for the supply of electric lighting material and fittings for the service from January 1st, 1909, to December 31st, 1910. Samples may be seen at the Casa Consistoriale Ayuntamiento Constitucional.

Trimdon Grange (Co. Durham).—December 12th. Electric fittings for a year for Walter Scott, Ltd., Trimdon Grange Colliery. Storekeeper, Trimdon Grange Colliery.

Yarmouth.—The Electricity Committee has decided to install two mechanical stokers at the works, at a cost of £475.

CLOSED.

Australia.—SYDNEY, N.S.W.—Postmaster-General :—

British Insulated & Helsby Cables, Ltd.—½ mile telephone cable, brass sheathed, rubber, 26 pairs, £300 per mile; 1 mile lead-covered cable, paper-insulated, 13 pairs, 72½-lb. conductors, £66 per mile; 9½ miles 26-pair ditto, £113 per mile; 2 miles ditto, 39 pairs, £144 per mile.
L.-R., G.-P. & T. Works Co.—Accumulator battery material.
Western Electric Co.—Switchboard cable and materials, telephones, &c.
British "Ever-Ready" Electric Co.—Dry cells.
Siemens Bros. Dynamo Works, Ltd.—2½ miles nautical submarine cable, £600 per nautical mile.
W. T. Henley's Telegraph Works Co.—½ mile switchboard cable, 27 conductors.

BRISBANE.—Postmaster-General :—

W. T. Henley's Telegraph Works Co.—20 miles s.w.g. V.I.R. copper wire, £6 10s. per mile.

MELBOURNE :—

British Insulated & Helsby Cables, Ltd.—11 miles telephone cable, 52 pairs, £246 per mile; 5 miles ditto, 208 pairs, £535 per mile; 1½ miles ditto, 260 pairs, £630 per mile.
W. T. Henley's Telegraph Works Co.—5 miles telephone cable, 26-pairs, £147 5s. per mile; 12 miles ditto, 78 pairs, £313 10s. per mile.
Western Electric Co.—3 miles telephone cable, 156 pairs, £402 per mile; 80,000 paper sleeves, 2s. 6d. per 1,000.

Blackburn.—The T.C. on December 3rd accepted the tender of the Wigan Coal and Iron Co., Ltd., for coal for the electricity works.

Burnley.—The Electricity Committee has accepted the tender of Messrs. B. I. and H. Cables, Ltd., for the supply of 360 yards of ·2 sq. in. cable, 180 yards of ·1 cable, 85 yards of ·75 cable, and 50 yards of ·5 cable.

Cape Town.—The City Council has accepted the tender of the Western Electric Co. for the supply of high and low-pressure cable in connection with the scheme whereby the Council delivers energy in bulk to the Government and Harbour Board.

Chatham.—The T.C. has accepted the tender of the British Thomson-Houston Co. for the annual supply of the following incandescent electric lamps:—8 C.P., 16 C.P. and 25 C.P., £3 12s. per gross; 32 C.P., £4 16s. per gross; and 50 C.P., £8 14s. per gross.

Derby.—The Electricity Committee has accepted the tender of the Derby Coal Co., Ltd., for 1,000 tons of coal.

Glasgow.—The Tramways Sub-Committee on Works and Stores recommends the acceptance of the following:—

Car rheostats and armature coils.—British Westinghouse Co.
Slate slabs for Rutherglen switchgear.—Currie & Co.
Bushes for trolley heads.—Fleming, Birkby & Goodall, Ltd.
Main field resistances for Pinkston generator.—B.T.-H. Co.
Scrap lead, copper.—Samuel Galbraith.
Turnings and borings.—Osbourne & Co.
Vulcanised cable, German silver.—Shearer Bros.
Rubber.—G. H. Steadwood.

London.—Woolwich.—The B.C. has received the following tenders for the supply of arc lamp carbons:—

Description of carbon offered.	General Electric Co., Ltd.	Oliver Arc Lamp, Ltd. (accepted for all items).	Siemens Dynamo Works.	Ship Carbons.	Brockie Arc Lamp Co.	Sloan Electric Co., Ltd.
	£	£	£	£	£	£
1) 12,000 pairs 18 mm. by 12 in. long, solid, for Oliver lamps	71	84	94	85	92	84
2) 40,000 pairs yellow flame carbons, with ordinary core, 7 mm. dia. by 12 in. long, 6·35 mm. by 12 in. long for Oriflamme lamps	—	110	184	110	159	144
3) 2,000 pairs carbons, enclosed lamps, 11 mm. dia. by 12 in. long, solid, for Brockie-Pell lamps	8	4	8	9	9½	9
4) 2,000 pairs yellow flame carbons, with metal core, for Excello lamps, 9 mm. dia. by 15 in. long, 10 mm. dia. by 15 in. long	43	21	22	21	24	22
5) 5,000 pairs yellow flame carbons, with large soft cores, for Johnson and Phillips's lamps, 9 mm. dia. by 15 in. long, 8 mm. dia. by 15 in. long	—	18½	—	—	—	—
6) 15,000 pairs yellow flame carbons, with metal core, for Oriflamme alternating lamps, 7 mm. dia. by 12 in. long	—	43	94	44	66	60
(7) 5,000 pairs flame carbons, for Excello lamps, 8 mm. by 15 in., 9 mm. by 15 mm.	48	45	50	—	58	—

Fulham.—The B.C. has received the following tenders for the supply of street lighting fittings in connection with the conversion of the whole of the 32-C.P. carbon-filament lamps now in use in the borough to 200-volt 75-C.P. Osram lamps:—

	Total cost.	Alter. cost.	Remarks.
Beeston Manufacturing Co.	£224	£244	£206 (if top casting in one piece)
Baxendale & Co.	214	232	
Wm. Edgar (accepted at £163)	149	171	£163 (with spring attachment)
Wm. Sugg & Co.	179	197	
Veritys, Ltd.	166	214	£201 (if with screws)
General Electric Co.	136	166	

(Exclusive of lamps and lampholders.)

The electrical engineer in his report stated that the tenders were for the same work and design, and only differed in regard to the quality of the glass. The tender is for a street fitting, with an 8-in. circular globe, suitable for a 70-C.P. metallic-filament lamp. The alternative price is for the same fitting, but with a larger well globe, suitable for a metallic-filament lamp of 100 C.P. In giving an estimate he had stated that the cost would be about 10s. 6d. per fitting, delivered, fixed, and with all necessary alterations to existing brackets. The tender of 7s. 9d. each would enable them to carry out the work of fixing probably inside the 10s. 6d. mentioned; but since making the estimate, from observations he had made, he favoured the fitting with the larger globe, as it would enable the Committee at any future time to use the larger Osram lamp without any alteration to the fitting. It would also enable them to get globes which were much clearer and made of better glass than the small circular 8-in. globes, which were usually of foreign manufacture and of very common glass.

The engineer's views were adopted by the Committee, and the tender mentioned was accepted.

L.C.C.—The Stores Committee reported at Tuesday's meeting that it had accepted tenders from the following for electric carbon brushes and carbons (Schedule No. 6 A):—Le Carbone, Morgan Crucible Co., Ltd., and the Sloan Electrical Co., Ltd.

For electric lamps, as per Schedule No. 6 E, contracts have been placed as follows:—

Cryselco, Ltd.—Value £200.
Edison & Swan Co.—Value £146.
General Electric Co.—Osrams (no quantity stated).
H. G. Mayer & Co.—Standard tantalum (no quantity stated).
Pope's Electric Lamp Co.—Value £1,520.
Siemens Bros. Dynamo Works.—Sun tantalum (no quantity stated).

The Highways Committee has considered the following tenders for (1) the roadwork and platelaying in connection with the reconstruction on the conduit system of the tramways from the "Britannia," Camden Town, to Hampstead Heath, and for (2) the supply of six fuel economisers at the Greenwich station:—

1.—Tramway Reconstruction.

	Tramway works.	Paving works.	Total.
W. Manders (recommended)	£33,318	£1,784	£35,101
A. M. Coles	34,519	1,218	35,738
Mowlem & Co.	34,621	1,723	36,344

2.—Six Fuel Economisers.

J. Carter & Sons	(not to specification)	£3,360
E. Danks & Co.		3,378
E. Green & Son	(recommended)	3,874
Goodbrand & Co.		3,935
Roberts Bros.		3,957
A. Lowcock, Ltd.		3,960
Clay Cross Co.		3,990

Richmond.—The Richmond (Surrey) Electric Light and Power Co., Ltd., have ordered from Messrs. Ed. Bennis & Co., Ltd., four "Bennis" stokers and self-cleaning compressed-air furnaces for Davey, Paxman boilers.

Stockport.—The T.C. has accepted the following tenders:—

Frank Pearn & Co., Ltd.—Boiler feed pump for the electricity works, £138.
McClure & Whitfield.—20-H.P. motor to drive pump, £135.
Estler Bros.—Materials for overhead equipment of tramways, £62.

Tunbridge Wells.—The T.C. has accepted the tender of Messrs. S. E. Haward & Co., Ltd., Tunbridge Wells, for electric fittings for the storerooms, &c., at the Town Hall Yard, at 13s. 6d. per light.

Walthamstow.—Correction.—We learn from Messrs. Wm. Geipel & Co. that the note in our last issue was incorrect in stating that they had received a contract for Conradty carbons. Their contract is for Henrion carbons.

West Ham.—The T.C. has accepted the tender of Mr. J. T. Halsey, at £58, for overhauling the electric light installation at the hospital, and providing and fitting transformers for metallic-filament lamps.

Whitby.—The U.D.C. has accepted the tender of Messrs. Callender's Cable and Construction Co., Ltd., for cable for the harbour works, at £455.

Yarmouth.—The Electricity Committee has placed an order for 2,000 tons of anthracite coal, at 9s. 3d. per ton, with Messrs. W. Cory & Son, Ltd.

CONTRACTORS' COLUMN.

The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERFELDY (Perth).—Hospital (£3,000). Dunn & Watson, architects, 35, Lincoln's Inn, London, W.C.

ACCRINGTON.—Public baths, laundry, boiler house, &c., for the T.C. W. J. Newton, borough engineer.

ALDERSHOT.—Houses, Sebastopol Road, for G. Greenwood; York Road, for Miss Pullinger; conversion of premises, High Street, into Salvation Army Hall.

ASTON (Birmingham).—New blocks at the Workhouse. Whitwell & Son, architects, 1, Newhall Street, Birmingham.

ATHERTON (near Manchester).—Proposed extension of local gas works. Surveyor, Council Offices, Atherton.

BARROW-IN-FURNESS.—Sixteen houses in Roose Road and North Street, for W. Yates.

BEDFORD.—Houses, Pemberley Avenue, for P. J. Dunstall, builder, Bromham Road; Dudley Street, for W. Braybrook; Bromham Road, for S. Constant, builder, 186, Castle Road; 14, Grove Place, for T. J. Topham & S. Barnwell; Beverley Crescent, for C. Negus, builder, 37, Tavistock Street; Campbell Road, for Jacobs and Burton; Beverley Crescent, for C. Melcombe & Son, builders, 14, Castle Road; workshop and stables, 39, Ampthill Street, for G. Hutchings; offices, St. Loyes Street, for D. Piper.

BELTINGE (Kent).—Church. W. D. Caroe, architect, 3, Great College Street, S.W.

BEXLEY.—Three houses, Princes Street, Bexley Heath, for J. Carter mission room, Day's Lane, Lamorbey, for Rev. J. F. Lepine; W. Harbrow, builder, Niel House, Bidcup, Kent.

BIRMINGHAM.—Proposed new Baths at Stirchley; J. P. Osborne, architect, Colmore Row, Birmingham. Alterations to licensed premises, Carver Street, for Mitchells & Butlers, brewers, and Coplow Street and Landor Street, for W. Butler & Co., brewers, Wolverhampton. Additions to the Central Library (£4,165); W. & J. Webb, builders, 257, Great King Street, Birmingham. New Church at Hasbury; Rev. Canon Hill, rector of Halesowen. Tramways emergency station, Miller Street; H. E. Stilgoe, surveyor to City Council; E. Crowder, builder, 153, Farm Street, Birmingham. Roman Catholic Church of the Benediction; Nicol & Nicol, architects, 117, Colmore Row, Birmingham. Council School, Sladefield Road; Buckland & Haywood Farmer, architects, Norwich Buildings, Congreve Street, Birmingham.

BLACKWOOD (Mon.)—Important colliery developments; Bargoed Coal Co. Mr. O'Conner, manager, Abernant.

BLAIRGOWRIE (Perthshire).—Alterations and additions to C. Conacher's coachbuilding works in Jessie Street.

BOLTON.—Motor tower for J. Marsden & Co., cotton spinners.

BOSTON.—Houses, Norfolk Street, for H. Wells; Tawney Street, for F. Peck, shop, High Street, for G. White.

BOURNE END.—New Wesleyan Church. Vernon & Son, architects, High Wycombe.

BOURNEMOUTH.—Fire station for the T.C. at Winton. F. W. Lacey, borough engineer.

BREDBURY (CHESHIRE).—Additions to steel rolling mills for the executors of J. Mills; extensions to engineering works for Briddon and Fowler: eleven houses, Stockport Road, for J. H. Crompton.

BRIDLINGTON.—New chancel and organ chamber at the Church of St. Anne's at the Convalescent Home. W. S. Walker, architect, 52, Quay Road, Bridlington.

BRISTOL.—Reinstatement and partial rebuilding of 32 and 34, Lawrence Hill. H. J. Jones & Son, architects, 12, Bridge Street, Bristol. Extensive alterations to premises for Chas. S. Bailey, Ltd., ironmongers, Victoria Street, Bristol. Extension of premises, Stokes Croft, for Perry & Turner, Ltd., carriage and motor builders. Extensions at the disinfectant station, St. Philip's Marsh, for the T.C. (£867); R. Wilkins & Son, builders, St. Paul's, Bristol. Mortuary at Avonmouth, for the T.C.; J. James, builder, Stapleton Road, Bristol. Roman Catholic School, St. Nicholas (£3,000); the Rev. Canon Scholes, architect, Basingstoke.

BUILTH.—Important additions to police buildings, for Brecon County Standing Joint Committee. C. W. Best, county surveyor, County Hall, Brecon.

BURNLEY.—Proposed extension of the Corporation ice factory (£4,800).

BURTON-ON-TRENT.—Buildings for eye treatment at Infirmary.

BURY.—Probable re-erection (after fire) of Bridge Hall Paper Mills, for J. Wrigley & Sons, Ltd.

CAMBRIDGE.—Shop, &c., Newmarket Road, for E. Saint, Devonshire Road; additions to house, Hills Road, for the executors of the late G. Scales; Department of Agriculture for the Chancellor of Cambridge University.

CANNOCK (STAFFS.).—Houses, High Mount, Hednesford, for Samuel Robinson; Edward Street, Broomhill, for Joseph Bates; John Street, Chadsmoor, for Mrs. Smith.

CARDIFF.—Three houses, Clive Road, for W. R. Davies; W. H. D. Caple, architect, Church Street Chambers, Cardiff. Four houses in Pencisely Road, for Blacker Bros.; J. W. Rodger, architect, 14, High Street, Cardiff. Nine houses, Llsvane Street, for J. D. Owen, Brithdir Street; E. W. M. Corbett, architect. Six houses, Llanishen Street, for H. Coffin; Veall & Sant, architects. Warehouse in Oxford Street, for F. W. Wide; H. W. Hyde, architect. Stores and boiler house, for Morgan Crowther, in Northumberland Street; Veall & Sant, architects, 6, Arcade Chambers, High Street, Cardiff. Extension of premises in Tresilian Terrace, Cardiff Pure Ice Co.; E. W. M. Corbett, architect, Castle Street, Cardiff. New premises, 18 and 19, Quay Street, and 18, High Street, for J. R. Thomas; H. W. Hyde, architect. Six houses, Ilton Road, for Richards & Selby; six houses, Deri Road, for T. C. Clonter; eight houses, Kimberley Road, for W. G. Harding; five houses, Kimberley Road, for J. Elsworthy; 18 houses, Amesbury Road, for W. J. Hughes. Six houses, Westville Road, for Geo. Heywood; W. H. Scott. architect, 74, Stacey Street, Cardiff. Extension of carriage and motor premises, for Perry & Turner, Ltd., Frederick Street.

CARSHALTON.—Alterations and additions, Carshalton House. J. Tapply, builder, Canobias, Salisbury Road, Sutton.

CHATHAM.—New school (£15,000). H. Dunstall, architect, Chatham.

CHELMSFORD.—School (£20,000). C. & W. H. Pertwee, architects, Bank Chambers, New Street, Chelmsford.

CHELTENHAM.—Residence (£2,500). T. Malvern, architect, 21, Winchcombe Street, Cheltenham; A. Wilson, builder, Swindon Road, Cheltenham.

CHESTER-LE-STREET.—New theatre in Station Lane, for A. Denville.

CHIPPENHAM.—Warehouses and shops for Wholesale Co-operative Society. F. Harris, architect, Balloon Street, Manchester.

COLCHESTER.—Offices and new blocks at Workhouse. C. E. Butcher, architect, 3, Queen Street, Colchester.

COVENTRY.—Proposed extension of the Technical Institute, in Little Park Street. Coventry Education Committee.

CREWE.—Shop extensions, W. H. Clews additions to houses, Richard Street, Mr. Gordon; mission com in connection with St. Andrew's Church.

CRIEFF.—New villa, for Andrew Macgregor, veterinary surgeon.

DARLINGTON.—Proposed electric power installation at the works of the Blake Boiler Co., and also at the Wire Works.

DONCASTER.—New technical school (£10,000). Doncaster Corporation.

DROYLSDEN (near MANCHESTER).—Proposed new elementary school. Secretary, Ashton-under-Lyne Education Committee.

DUNDEE.—Restoration of Batching House for Ballingall & Son, Ltd.

DUDLEY.—Extension of Liberal Club premises (£500). Additions to Infirmary; Nicol & Nicol, architects, 117, Colmore Road, Birmingham.

EASTBOURNE.—Chapel at St. Cyprian's; F. G. Cooke, architect, 3, Hyde Gardens, Eastbourne. Ten houses, Desmond Road; Mitchell and Ford, architects, 7, Gildredge Road, Eastbourne. Alterations at Burlington Hotel; W. J. Blackhurst, builder, 51, Cavendish Place, Eastbourne. Alterations St. Saviour's School; R. H. Stanbridge, builder, St. Leonards Road, Eastbourne. Four houses, Prentice Road; C. Crisford, architect, 49, Gildredge Road, Eastbourne; Miller & Selmes, builders, 75, Tideswell Road, Eastbourne. Addition to Motcombe Farmhouse; R. Burke, architect, Crompton Estate Office, Eastbourne. Additions to Miravale, Furness Road. Two pairs of houses, Prentice Road; C. Crisford, architect, 49, Gildredge Road, Eastbourne.

EASTLEIGH (HANTS.).—Important extensions to the works of the London and South-Western Railway Co., to be electrically equipped.

ECCLES.—Nine houses, Lansdale Street, Peel Green, Patricroft, for T. Mosedale; additions to works, Monton Road, for the New Eccles Rubber Co.; important alterations at Patricroft Congregational Schools, Eccles.

EDINBURGH.—New Usher Hall in West Princes Street Gardens (seat 3,000). J. J. Burnett, London, and D. N. Dick & Thos. Tait, Edinburgh, joint architects.

ELTHAM.—Four houses, Glenlyon Road; J. J. Bassett, builder, 121, Earlshall Road, Eltham. New street from Glenlea Road to High Street; D. Watney & Sons, surveyors, 33, Poultry, E.C. Six houses, Dumbreck Road; J. J. Barrett, 121, Earlshall Road, Eltham. Converting 110, High Street into shop; T. W. Mills, care of Whistler & Worge, surveyors, 80, High Street, Eltham.

FAIRHAVEN (near LYTHAM).—Wesleyan Church extensions contemplated. Trustees.

FENTON.—School, Manor Street. S. B. Ashworth, architect, Old Bank Offices, Stoke-on-Trent.

FOLKESTONE.—Proposed music hall near the White Lion, Cheriton.

GILLINGHAM (KENT).—Eight villas, Barnsole Road, for Alderman J. R. Featherby; E. J. Hammond, architect, 21, Balmoral Road. Houses, Clive Road, for W. Dobson, builder, 2, Linden Road; E. F. Cobb, architect, 20, High Street, Rochester. Recreation room and dormitory, St. Chrietienne Convent School, Franklin Road; R. M. Godden, architect. House, Selborne Road, for C. Tanner; W. E. R. Randall, architect, 171, High Street, Chatham. Steam laundry, Richmond Road, for the Gillingham and District Steam Laundry Co.; T. Cornelius & Son, builders, Avondale Road.

GAINSBOROUGH.—Crown and Anchor Inn, Bridge Street, to be rebuilt, and model lodging house to be built adjoining.

GLOUCESTER.—Mission hall and Sunday School, Seymour Road (£4,700 J. F. Trew, architect, County Chambers, Station Road, Glos.; W. Crane, Ltd., builder, 82, Forest Road, Nottingham.

GOLCAR (YORKS.).—Sawing and planing mills, Crimble, for John Varley; house for D. Garside; house and shop, Leymoor Road, for J. H Kaye. House, Leymoor; Arthur Shaw, architect, Golcar.

GOSFORTH (near NEWCASTLE-ON-TYNE).—Proposed Catholic Club in connection with St. Charles Church.

GRAYS (ESSEX).—New Parish Hall. Rev. A. H. W. Seally, vicar.

HALIFAX.—Pavilion for the Bowling Club. W. L. Benn, 41, Commercia Street, Halifax.

HANDSWORTH (BIRMINGHAM).—Isolation hospital. Mr. Richardson, architect Town Hall, Handsworth.

HANLEY.—Alterations and additions to Lichfield Street Baths, for the T.C J. Lobley, borough engineer.

HARROW.—Secondary School (£16,815). H. T. Wakelam, surveyor to Middlesex County Council.

HASLINGDEN (LANCS.).—Drill Hall for the Haslingden Ambulance Corps.

HASTINGS (ST. LEONARDS).—Alterations to mansion, Lackby, Hollington Park; J. H. Upson, Esq. (owner); P. Tree, architect, London Road, St. Leonards. New house, Clifton Road, St. Helen's, for Geo. Judges; T. W. Elworthy, architect, London Road, St. Leonards.

HEATON.—Sixteen houses in Markland Avenue. British Millstone Grit Co., Ltd., Heaton.

HENLEY-ON-THAMES.—Two houses in Cromwell Road. W. H. Sarney, builder, Fernside, Berkshire Road, Henley.

HEREFORD.—Additions, Free Library; J. Parker, architect, City Hall, Hereford. Secondary school, Cattle Market; R. Jack, architect County Hall, Hereford.

HEXHAM.—New secondary school, for Northumberland C.C. Oliver, Leeson and Wood, architects, Milburn House, Newcastle-on-Tyne.

HEYWOOD.—New church of St. Ann. L. Barlow, architect, Manchester; S. Barker, builder, Pilsworth Road, Heywood.

HITCHIN.—Extension of the General Post Office.

HOVE.—Catholic Church. B. H. Dixon, architect, 35, East Street, Brighton.

HYDE.—Stables for the T.C. Borough surveyor.

HYTHE (KENT).—Houses, Brockhill Road, for P. Hoskins; Earlsfield Road, for Wm. Baker.

KILMUN (ARGYLL).—New hall and renovation of the church. Rev. A. W. McKinlay, minister of Kilmun Presbyterian Church.

KIRKHAM (LANCS.).—Proposed new public hall. Surveyor, Council Offices, Kirkham.

KIRTON-IN-LINDSEY (LINCS.).—Two houses, with coach house, stables, &c. J. K. Broughton, High Street, Kirton-in-Lindsey.

KNEBWORTH (HERTS.).—Council school.

LEEDS.—Conversion of Queen's Arcade Hotel into Café. W. Broadbent, architect, Red Hall Chambers, Guildford Street, Leeds.

LEIGH (LANCS.).—Alterations to property, St. Helen's Road, Mrs. and Miss Bent; alterations and additions to Firs Mill, Tunnicliffe and Hampson, Ltd.; Masons' sheds for Mr. Brocklehurse; 17 houses, Manchester Road, J. W. Cowburn, builder, Leigh; motor shed for Dr. Jones.

LEWES.—Important sewage scheme for the T.C. (£17,595). Brierley, Holt and Co., engineers, Blackburn and Blackpool.

LEYLAND (LANCS.).—Seventeen houses and shop in Meadow Street. Mrs. S. A. Clayton.

LINCOLN.—Water supply works for the T.C. at Elkesby (£7,768). A. C. Potter and Co., contractors, Lant Street, Borough, London.

LISCARD (CHESHIRE).—Enlargement of Emmanuel Church, Rake Lane.

LIVERPOOL.—Refreshment pavilion in Sefton Park, for the T.C. (£800); City Surveyor. Extensive additions to the workshops for the Outdoor Blind. Proposed extension of the Stewart-Jones Evening Homes; R. Burton Chadwick, hon. secretary. Catholic Memorial Hall; Dr. Mercer, Rector of St. Paulinus', Lostock Hall.

LLANDAFF.—Eight houses, Newfoundland Road, Gabalfa; G. Beard, builder, Llandaff North. Twelve houses, Newfoundland Road, Gabalfa: T. H. Price, builder, Llandaff North.

LLANDRINDOD WELLS.—Council offices for the Urban Council. Houses, Tremont Road, for J. Coombs; Spa Road, for A. Meredith.

LLANELLY.—New drill hall; West Wales Territorial County Association.

LLANDUDNO.—Extensive alterations and additions at Maine Hotel, with electric lifts. F. Newton, builder, Tilehouse Street, Hitchin, Herts.

LLANISHEN.—Two houses at the Oval. A. W. Chick, builder, Llanishen.
House and bakehouse, in Fidlas Road. H. Hanson, builder, Llanishen.

LONDON (TOOTING, S.W.).—Twelve houses in Fircroft Road. E. H. Evans, architect, 32, Craven Street, Strand, W.C.

(STRATFORD, E.).—Addition to factory for the British Ultramarine Co., Sugar House Lane, Stratford.

(HACKNEY, N.E.).—Three new streets on the Craven Park estate. J. Ellwood, architect, 50, Prince's Avenue, Church End, Finchley.

(PECKHAM, S.E.).—Buildings in Atwell Street. A. E. Mullins architect, 48, Peckham Road, S.E.

(WOOLWICH, S.E.).—R.A.M.C. officers' mess and quarters; Director of Barrack Construction. 80, Pall Mall, London, S.W. Iron building in Green Lane, for Western Electric Co.; B. Dawson, architect, 6, Old Queen Street, S.W. Building, Henley Road W. T. Henley's, Telegraph Works Co., Ltd., N. Woolwich Additions, Siemens Bros. & Co., Ltd., factories, Bowater Road A. Sabine, secretary.

(BETHNAL GREEN, N.E.).—Buildings in Cambridge Circus, for th Peabody Donation Fund. W. E. Wallis, architect, 12, Buckingham Street, Strand, W.C.

(BOW, E.).—Alterations at Atley Road School. T. J. Bailey education architect, L.C.C. offices, Victoria Embankment W.C.

(W.C.).—Adaption of temporary office of *Morning Post* in Aldwych as skating rink. E. J. Wilson, 135, Adelaide Road, N.W.

(N.).—Fitting of disused tramway depôt in Holloway Road as skating rink. E. J. Wilson, 135, Adelaide Road, N.W.

(NORWOOD, S.E.).—Buildings in Canterbury Grove. E. I'Anson and Son, architects, 7A, Laurence Pountney Hill, E.C.

(WIMBLEDON COMMON, S.W.).—Additions at Gayton Lodge, Park Side. Maple & Co., Ltd., Tottenham Court Road, W.

(HARLESDEN, N.W.).—Sorting room and boiler house, Carlyle Avenue; H. Shaw, architect, 60, Nicoll Road, Willesden. Bake house rear of 5, High Street; S. W. Cranfield, architect, 14 South Square, W.C.

(STONEBRIDGE, N.W.).—Alterations, Stonebridge Park Laundr Barry Road. S. Catling, estate agent, Wembley Hill Station.

LONDON.—(Continued).—(BLOOMSBURY, W.C.).—Proposed new Court House in Hunter Street (£82,190). W. E. Riley, superintending architect, L.C.C.

(SILVERTOWN, E.).—New ambulance, fire station and belt store at the premises of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd, Silvertown. Offices, 106, Cannon Street, E.C.

(SOUTHGATE, N.).—Isolation hospital (£5,600). C. G. Lawson, surveyor to Urban District Council.

(CRICKLEWOOD, N.W.).—Proposed Church Hall. Hudson & Hunt, architects, 24, York Place, W.

(ACTON, W.).—Laundry at Church Path for A. J. Smith, 176, Bollo Bridge Road, Acton, W.

(BATTERSEA, S.W.).—Church, Culmstock Road and Alfriston Road. J. S. Quilter & Son, architects, 1 and 2, Adam Street, Adelphi, W.C.

(ROTHERHITHE, S.E.).—School, Cow Lane (£14,465). T. J. Bailey, architect to L.C.C. Education Committee, Victoria Embankment. Kirk & Randell, builders, Woolwich.

(GREENWICH, S.E.).—School, Sherington Road (500 places). T. J. Bailey, architect to L.C.C. Education Committee, Victoria Embankment.

(ISLINGTON, N.).—Six blocks of artisans' dwellings, Liverpool Road, for the Lewis Trust (£47,247). G. E. Wallis & Sons, builders, Broadmead Works, Hart Street, Maidstone.

(KILBURN, N.W.).—Enlargement and improvement of the Kilburn Grammar School, for the Middlesex C.C. (£4,000).

(ST. GEORGE-IN-THE-EAST).—School, Fairclough Street (968 places). T. J. Bailey, architect to L.C.C. Education Committee, Victoria Embankment.

(ISLINGTON, N.).—School, Shelburne Road (500 places). T. J. Bailey, architect to L.C.C. Education Committee, Victoria Embankment.

(SOUTHGATE, N.).—County School (£13,700). H. T. Wakelam, Surveyor to Middlesex County Council, Guildhall, Westminster.

(WOOD GREEN, N.).—County School (£12,700). H. T. Wakelam, Surveyor to Middlesex County Council.

(EALING, W.).—Church House for St. Saviour's Church (£3,500). G. H. Fellowes Prynne, architect, 6, Queen Anne's Gate, S.W.

(BARNES, S.W.).—Shops, Grove Road. P. V. Windebank & Co., builders, St. Olaves, Sutton.

(MARYLEBONE, W.).—Buildings at corner of Duke Street, Oxford Street. R. F. Atkinson, architect, 8, Sackville Street, W.

(KENSINGTON, W.).—Additions to No. 34, Holland Park, for Sir I. Hart. J. Kinninmont & Sons, builders, 1, 2 and 3, Eastbourne Mews, Paddington, W.

(WANDSWORTH, S.W.).—Shops, 45, 46, Rostella Road. F. G. B. Crawley, 114A, Chancery Lane, W.C.

(WIMBLEDON, S.W.).—Church, Cotterham Park. E. C. Shearman, architect, "Bynelmscote," Winchester. Extension of depôt; C. H. Cooper, surveyor to Town Council. Proposed Town Hall and Municipal Offices; C. H. Cooper, surveyor to Town Council.

(WEST HAM, E.).—Theatre (£18,000). B. Crewe, architect, 75, Shaftesbury Avenue, W.C. Two new roads; Arthur Single, estate agent, 85, The Grove, Stratford, E.

(W.).—Extension of premises of Chas. Lee & Son, costumiers, 98-100, Wigmore Street, W. Building, 66, Whitcomb Street, Piccadilly Circus; Barlow & Roberts, builders, 15, Red Cross Street, Southwark, S.E. Shop, &c., 33, Paddington Street; J. Simpson and Sons, builders, 48, Paddington Street, W.

LONDONDERRY.—New Police Court (£1,350). W. M'Elwee, architect, 36, William Street, Londonderry. New Morgue also contemplated.

LONGTON.—Two power houses, at the Corporation sewage farm. J. Walters, jun., builder, Ayshford Street, Longton.

LOWESTOFT.—Two Houses, Royal Avenue; G. Fitt, Gunton Esplanade Lowestoft. Two houses and shops, Cliff Road, South Lowestoft; E. Graveling, London Road, South Lowestoft. Probable re-erection (after fire) of Commercial Road saw-mills, for T. Saul & Sons.

LOW MOORSLEY (HETTON-LE-HOLE, Co. DURHAM).—Alterations and additions to premises, for the Low Moorsley Co-operative Society.

LUTON.—New Carnegie library; borough engineer. Workrooms, 16, Inkerman Street, for S. Wingrave; workshop, New Bedford Road, for E. L. Barber; workshop, Dallow Road, for J. Sinfield, builder, 1, Grove Road.

LYNTON.—Shops, facing the market. B. Jones, builder.

MAIDENHEAD.—Pair of semi-detached villas, Keble Road, for J. L. Bissley; additions to villa residence, for W. F. Good; alterations and additions to Moffatt Arms, for Nicholson & Sons, brewers, High Street; stable and coach-house, Laburnham Road, for T. Martin.

MANCHESTER.—Alterations to business premises in Deansgate; G. Jones and Son, contractors, 17, Atkinson Street, Deansgate, Manchester. Proposed housing scheme; Secretary, Co-operative Wholesale Society, Manchester. Eight houses in Stone Street, Tonge; H. Collier.

(TRAFFORD PARK).—New works to be built by the Trafford Park Estates Co., Ltd., in conjunction with Steel, Lockhart & Co. (Lord Grimthorpe, chairman.)

MANSFIELD.—Probable reinstatement of premises, after fire, Albert Street, for Jas. Alston, wine and spirit merchant.

MANSFIELD WOODHOUSE.—Cemetery Chapel, caretaker's house, &c., for the U.D.C. A. R. Roe, builder, Mansfield.

MARLOW.—Additions to works, Dedmere Road, for the Bucks Chair Co.

MERTHYR TYDFIL.—Thirty-eight houses at Danyderi, Merthyr Tydfil, and 68 at Penywern, Dowlais. Borough surveyor, Town Hall, Merthyr Tydfil.

MOLESEY.—Isolation hospital (£3,645). Surveyor, Molesey District Council.

MOORTOWN (near LEEDS).—Pair of villas, Sand Hill Lane, for Mrs. Taylor Messrs. Mosley, 6, Wormald Row, Leeds.

NEWCASTLE-ON-TYNE.—Proposed new baths. Corporation.

NEWPORT (MON.).—Development of Somerton Garden Suburb Estate for building. Newland, Davis & Hunt, architects, 19, Commercial Street, Newport.

NEWQUAY.—Workshops for H. Hocking, builder, Mount Wise; dwelling-house for Mr. Pappin, builder, Mount Wise; two houses for R. J. Pearce, builder, Mount Wise; three houses for Mr. Billingham, builder, Island Estate; slaughter-house for Mr. Hubber.

NORTHALLERTON.—Important sewage works for the U.D.C. (£10,000). Wilcox & Raikes, engineers, Birmingham.

NORTHAMPTON.—Proposed erection of 50 houses, near Monks Park, for Sir Henry Randall. Four houses, Ashburnham Road; A. Glenn, builder, 54, Ashburnham Road, Northampton.

NORTH BROOMHILL (NORTHUMBERLAND).—Proposed alterations to branch premises for the Broomhill Co-operative Society, Ltd. Secretary, Central Offices, Co-operative Society, Broomhill.

NORTHUMBERLAND.—Electrical work for new schools and existing buildings for the County Education Committee. C. Williams, secretary, the Moothall, Newcastle-on-Tyne.

NOTTINGHAM.—Proposed new School at Sherwood (£21,200); extension of Berridge Road and Clarendon Street Schools; Nottingham Education Committee. Skating rink, for Frank Bostock; T. V. Woodhouse, architect, West Bridgford, Nottingham.

OLDBURY.—Shops, Birmingham Street, for T. Newman; extension of works, Rood End Road, for Rider & Co.

OXFORD.—Alterations and additions to East Oxford Police Station, for the T.C. (£919). Wooldridge & Simpson, builders, Oxford.

PARKSTONE (DORSET).—Proposed new church and parsonage at Sandbanks. Rev. R. L. Kingsford, hon. sec.

PENMAENMAWR (CARNARVON).—Monastery for the Franciscan Capuchins Brotherhood. Rev. Canon Scholes, architect, Basingstoke.

PENTYRCH.—Two houses at Creigiau, D. James, builder, Pentyrch; two houses at Creigiau, W. Rees, builder, Pentyrch; house at Gwaelodygarth, W. Davies, builder, Pentyrch.

PLYMOUTH.—Proposed reinstatement (after fire) of premises in Tavistock Road, for C. Widger, Son & Co. Roman Catholic School, North Division; Rev. Canon Scholes and C. Raymond, architects, The Presbytery, Burgess Road, Basingstoke.

POOLE.—Houses, off Richmond Road, for J. A. Cocker; Cliff Drive, Canford Cliffs, for T. Stevens; Forest Road, for W. Southgate; Shore Road, Sandbanks, for P. W. De la Motte; Cliff Drive, for A. W. Field: Poole Road, for W. Southgate; Penn Hill Avenue, for J. Wright; Flaghead Road, for T. B. Scott and H. Newman; Birchwood Road, for G. Lane.

PORTSMOUTH.—Two houses in Milton Road, for J. Durrant; houses in Funtington Road, for R. J. Winnicott.

PORT TALBOT.—Proposed extensive works for the manufacture of patent fuel, coke and by-products.

RAINSHAW (near EVENWOOD, Co. DURHAM).—New County school. County Education Architect, Shire Hall, Durham.

RASTRICK (near BRIGHOUSE).—Proposed new church for St. John's parish.

READING.—Suggested enlargement of Park Hospital; W. S. Clutterbuck, Town Clerk, Reading Corporation. Additions to St. Andrew's Hostel, London Road, for Miss Bolam, 109, London Road, Reading.

REDCAR.—Alterations and extensions to farm buildings for the Marquess of Zetland. Thos. E. Senior, Zetland Estate Offices, Marske-by-the-Sea.

RETFORD.—New dispensary in connection with Retford Hospital. H. Derrison, Chairman of Committee.

RIPON.—Improvements at the North-Eastern Railway Station. Wm. Bell, architect to the company, York.

ROMFORD.—Parish hall, Church Path; Nicholson & Corlette, architects, 2, New Square, Lincoln's Inn, W.C. Bungalows, Oak Street, for James Butterfield, Fernside, Oak Street.

ROSS (HEREFORDSHIRE).—Secondary School. A. Small, architect, Gloucester Road, Ross.

ROTHERHAM.—Pair semi-detached villas, Gerard Street; Richard Snell, builder, 39, St. Anne's Road. New schools at Ravenfield, for the West Riding of Yorks C.C.; Jas. Totty, architect, Moorgate Street, Rotherham. School (200 places) St. Bedes Road, for managers of R.C. Schools. Five houses and motor-wagon sheds, St. Anne's Road, for Watt & Fergusson; J. Platts, architect, High Street, Rotherham.

RUGBY.—Infectious diseases hospital. T. Willard, architect, Market Chambers, Rugby. Proposed baths, for the T.C. (£,200).

RUISLIP-NORTHWOOD.—Four houses, Sharp's Lane. Collins & Charles, builders, 18, High Street, Harrow.

ST. MARY CRAY.—New Council School (300 children). W. H. Robinson, architect to the Kent Education Committee, Caxton House, Westminster, S.W.

SALISBURY.—Business premises, Butcher Row and Ox Row, for Hart & Son. A. C. Bothams, architect, 32, Chipper Lane, Salisbury.

SHEERNESS.—Houses, Invicta Road, for Wilson, Edsall & Moxon, builders.

SILKSWORTH (near SUNDERLAND).—Two houses, Somerset Street, for W. Watson & Co.

SOUTHEND-ON-SEA.—Alterations and additions to the Victoria Hotel. E. A. Broadhurst, licensee.

SOUTHPORT.—Homœpathic hospital. P. Adams, architect, 29, Woburn Place, London, W.C.

SOUTHSEA.—Catholic Church of St. Patrick (£10,000). J. G. Smith, architect, Victoria Road North, Southsea.

SPENNYMOOR (Co. DURHAM).—Houses, Ruby Terrace, for W. Gill; Ruby Terrace, for Geo. Myers; Durham Road, for T. Pearson; warehouse, Back King Street, for John Webb.

STAMFORD.—Probable re-erection (after fire) of business premises, St. Mary's Hill, near Town Bridge; R. Mould, draper, occupier.

STANDISH (near WIGAN).—Probable re-erection (after fire) of Prospect House, for J. M. Ainscough.

STEVENAGE.—Houses, Walkern Road, for Miss M. K. Marsh; additions to "Sishes," for Julius Bertram, M.P.

STOCKPORT.—New schools at North Reddish. Cheers & Smith, architects, Blackburn.

SWANSCOMBE.—Proposed elementary school at Knockhall, for the C.C. F. W. Crook, secretary to the Kent Education Committee, Caxton House, Westminster, S.W.

SWANSEA.—Alterations at the Workhouse; Llewellyn Jenkins, clerk, Alexandra Road, Swansea. Gymnasium, dining-room, &c., at the Grammar School, for the T.C. (£4,000). E.L. installation at the Education Offices for the Education Committee, and at Port Tennant Police Station for the Watch Committee; new business premises, High Street, for D. Jones & Co., Ltd., clothiers.

TODDINGTON.—New school for Beds. C.C.

TRURO.—Rebuilding West-End Drapery Stores. A. J. Cornelius, architect, Lemon Street, Truro.

TUNBRIDGE WELLS.—House, Sandhurst Road, for Soper & Jones, builders, 75, Calverley Road; motor garage, London Road, for G. Stevenson; house and shop, St. John's Road, for E. and H. Kelsey, brewers, Culverden Brewery.

USWORTH (Co. DURHAM).—Workmen's dwellings (50), for the C.C. Brown and Spain, architects, 51, Fawcett Street, Sunderland.

WATFORD.—Drill Hall, Park Avenue. Commanding Officer.

WEST BROMWICH.—Cookery kitchen and students' dining-room in connection with the Secondary School. Wood & Kendrick, architects, High Street, West Bromwich.

WHITBY.—Residence, Carr Hill; H. G. Walker, architect, Golden Lion Bank, Whitby. House, St. Hilda's Terrace, for W. James; J. Parker, architect, Oak Terrace, Whitby.

WHITCHURCH.—Housed on Parade, Whitchurch; W. S. Lewis, builder, Whitchurch. Additions to Royal Exchange Hotel. S. A. Brain and Co., Ltd, Cardiff. Ten houses at Pantmawr Road; H. Gummar, builder, Whitchurch.

WHITEFIELD (near MANCHESTER).—Proposed public waiting rooms and conveniences. Borough surveyor, Bury.

WIGAN.—Alterations at the Public Baths. Borough surveyor, Wigan.

WINDERMERE.—Extension of garage and motor works at Bowness for H. J. Croft. J. Stalker, architect, Kendal.

WINDSOR.—Proposed reconstruction of Victorian St. Baptist Church (£3,000); Rev. C. H. Sheen, minister; A. T. C. Roberts, hon. sec. Re-erection of premises for Mr. Wilkinson, decorator, 126, High Street, Eton. Erection of chemistry school, Keat's Lane, in connection with Eton College.

WORTHING.—Additions to Downview Hotel, for Abbey & Sons, Brighton; houses, Boundary Road, for Hayward & Co.; Upper High Street, for G. Hide; High Street, Tarring, for Tate & Co. (J. E. Lund, architect, The Cove, Christchurch Road, Worthing); Southfield Road, for A. Warner; Tarring Road, for J. Hews (H. Bartlett, architect, Heytesbury House, Worthing).

YARMOUTH.—Proposed extensions to the General Hospital (£3,800), Councillor R. F. E. Ferrier, hon. sec.; alterations to Steam Packet Hotel, Marine Parade, for Messrs. Steward & Patteson, owners; two houses, Alderson Road, for C. E. Ward.

YNYSCYNHAIARN.—Important sewage disposal works for the U.D.C. F. J. Commin, engineer, 1, Victoria Street, Westminster, S.W.

FORTHCOMING EVENTS.

Physical Society.—Friday, December 11th. Meeting at 8 p.m At the Royal College of Science, South Kensington. Fourth Annual Exhibition of Electrical, Optical and other Physical Apparatus, from 7 to 10 p.m.

Junior Institution of Engineers.—Saturday, December 12th. At 8 p.m. Visit to garage and shops of London General Omnibus Co., at Black Horse Lane, Walthamstow. This visit is in connection with a paper that is to be read by Mr. Eric Boult on "Motor-Omnibuses," on December 16th.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 12th. Meeting at 2 p.m.

Birmingham and District Electric Club.—Saturday, December 12th. At 7 p.m. At the Colonnade Hotel, Birmingham. Fourth annual meeting.

Electrical Football League.—Saturday, December 12th. Kick-off at 2.30 p.m. Ediswan *v.* Robertson's Lamps, at Wormholt Farm, Shepherd's Bush.

Institution of Mechanical Engineers (Graduates' Association).—Monday, December 14th. At 8 p.m. Paper by Mr. Reginald Bishop on "Commercial Precision Grinding."

Institution of Electrical Engineers (Manchester Section).—Tuesday, December 15th. At 7.30 p.m. At the University, Manchester. Paper on "The Electrical Discharge and the Manufacture of Nitrogen Compounds," by Mr. W. Cramp.

Faraday Society.—Tuesday, December 15th. At 8 p.m. At the Library of the I.E.E., London, S.W. Paper on "The Redetermination of the Electrolytic Potentials of Silver and Thallium," by Mr. F. J. Brislee; and other papers.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, December 16th. At 7.30 p.m. At the University, Birmingham. Paper on "The Use of Transformers as Choking Coils, and Applications to the Testing of Alternators," by Mr. J. D. Coales.

Institution of Electrical Engineers (Students' Meeting).—Wednesday, December 16th. At 7.45 p.m. At the Library of the Institution. Paper on "Auto-Transformers for Metallic-Filament Lamps," by Mr. G. H. Stevens.

Institution of Electrical Engineers (Leeds Local Section).—Wednesday, December 16th. At 7.15 p.m. Meeting at the University, Sheffield.

Junior Institution of Engineers.—Wednesday, December 16th. At 7.30 p.m. At the Royal United Service Institution. Paper on "Motor Omnibuses," by Mr. E. F. Boult.

Institution of Electrical Engineers.—Thursday, December 17th. At 8 p.m. At the Institution of Civil Engineers. Paper on "The Electric Discharge and the Production of Nitric Acid," by Messrs. W. Cramp and B. Hoyle.

Institution of Electrical Engineers (Glasgow Students).—Friday, December 18th. At 8 p.m. At the Glasgow Technical College.

Electro-Harmonic Society.—Friday, December 18th. At 8 p.m. At the Holborn Restaurant (King's Hall). Smoking Concert.

Institution of Civil Engineers (Students' meeting).—Friday, December 18th. At 8 p.m. At the Institution of Civil Engineers. Paper on "High-Power Water-Turbines on Moderate Falls," by Mr. R. Wolfenden.

Association of Engineers-in-Charge.—Saturday, December 19th. At 7.30 p.m. At St. Bride's Institute, London, E.C. Discussion on paper on "Coal," by Mr. W. H. Booth.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Monday, December 14th.—"A" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 10 p.m.

Tuesday, December 15th.—"B" Company. Technical drill, 6 to 8.30 p.m. Infantry drill, 8.45 to 9.45 p.m. Medical inspection for recruits, 6.30 to 7.30 p.m.

Thursday, December 17th.—"C" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 10 p.m.

Friday, December 18th.—"D" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7.15 to 9.30 p.m.

The Head-quarters will be closed from December 23rd to January 3rd, both dates inclusive.

(Signed) J. H. S. Phillips.
Capt. and Acting Adjutant.

Alleged Libel.—At Tottenham Police Court on the 3rd inst., Thomas Bray, of Peacock Street, Newington Butts, was summoned for publishing alleged libels concerning Thomas Ward, of Totteridge Road, Enfield Wash, lately a director of the Electrical Instruments Manufacturers, Ltd. Mr. Louis Green, counsel for the complainant, said that if the defendant would give an undertaking not to repeat the libels, he did not desire to proceed with the case. The defendant at first expressed a desire to have the case proceeded with, but upon the chairman pointing out that the Bench would have no option but to commit him for trial, he gave the required undertaking.

NOTES.

Our December 25th Issue.—The Electrical Review, which is due to appear on Christmas Day, will be published on the previous Wednesday morning, December 23rd. Will our friends therefore kindly take note of the following arrangements, so as to avoid disappointment and delay?

All matter for the "Correspondence" pages should reach this office by first post on Monday morning, December 21st. Notes and news matter should be received in the course of the same day, though late news of special interest will be welcomed up to early on the morning of Tuesday, December 22nd.

Our Advertisement Department announces that new copy and alterations to existing displayed advertisements should reach it not later than Friday morning 18th inst. Official Notices and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday, the 22nd.

Apparent Decay of Radium.—Under this head, in *Nature* of December 3rd, Prof. Sir W. Ramsay describes observations carried on during the past year, upon the amount of "electrolytic gas" obtainable from a solution of radium bromide. About 30 cm.^{3} of the gas were pumped off every week until November 11th, after which date the quantity diminished rapidly, amounting only to 0·5 cm.^{3} at the end of November. It is suggested that here is a proof that one of the ways in which radium expends a portion of its energy has been stopped.

In the same issue Mr. F. Soddy gives an account of experiments showing that helium is evolved from uranium, at the rate of about 2 milligrams of helium per annum per million kilograms of uranium.

Copper.—Copper has settled a little as to price, and also as to the abnormal increase in visible supplies. These are given in Messrs. Merton's report as 51,999 tons for November 30th, 1908, an increase of 467 tons over the quantity for the end of December, but a decrease of 836 tons from the mid-monthly figures. This loss is principally on afloat from Australia, and therefore may only be an ordinary fluctuation, due to the in and out shipping not coinciding in tonnage. Deliveries are slightly down, 29,239 tons, as against 34,038 tons at the end of December, and total supplies are below the average.

Institution and Lecture Notes. — Institution of Electrical Engineers (Birmingham Local Section). — The second annual dinner was held last week at the Grand Hotel. Professor G. Kapp presided, and proposed the toast of "The Institution." In the course of his speech he mentioned that the parent body had appointed a committee to inquire into the qualifications of those who desired to become members, and was going to institute an examination for associate membership, with a view to raising the status of the Institution. The President, Mr. W. M. Mordey, replied, and said that this country was not behind others in electricity supply—not even, he believed, behind America. Mr. R. K. Gray proposed "The Birmingham Local Section," for which Prof. Threlfall replied. Other toasts followed, and Mr. J. F. C. Snell pointed out that in 1908 the capital invested in electrical undertakings was no less than 366 millions sterling, with an average return of 4·83 per cent.

Institution of Engineers and Shipbuilders in Scotland.—On Thursday, December 3rd, the new buildings erected in Glasgow by the Institution were opened with a conversazione. The buildings contain a literary and reading room, smoking and coffee rooms, lecture hall, council room, &c.

Society of Engineers.—On December 7th Mr. Herbert Chatley read a paper on "Mechanical Flight," dealing successively with the history of the subject, the theory, and the application of the theory to practical design; he described the essential features of four types of aëroplane, and concluded by shortly considering the commercial and military aspects of the question.

Royal Institution. — The following are included among the lecture arrangements before Easter: — Prof. W. Stirling, a Christmas course of six experimentally illustrated lectures on "The Wheel of Life," adapted to a juvenile auditory; Prof. J. O. Arnold, two lectures on "Mysteries of Metals"; and Prof. Sir J. J. Thomson, six lectures on "Properties of Matter."

The Royal Society.—Before this Society yesterday the following papers were to be read:—

Prof. T. B. Wood and W. B. Hardy, F.R.S. "Electrolytes and Colloids. The Physical State of Gluten."

W. F. G. Swann. "On the Specific Heats of Air and CO_2 at Atmospheric Pressure by the Continuous Electric Method at 20° and 100° C." Communicated by Prof. H. L. Callendar, F.R.S.

J. W. Bispham. "Potential Gradient in Glow Discharges from a Point to a Plane." Communicated by Prof. Sir J. J. Thomson, F.R.S.

Commander L. Chetwynd, R.N. "Results of Magnetic Observations at Stations on the Coasts of the British Isles, 1907." Communicated by Admiral A. M. Field, F.R.S.

J. Nicol. "The Rotation of the Electric Arc in a Radial Magnetic Field." Communicated by Prof. H. A. Wilson, F.R.S.

T. Royds. "A Comparison of the Radium Emanation Spectra Obtained by Different Observers." Communicated by Prof. E. Rutherford, F.R.S.

Junior Institution of Engineers.—With the permission of Mr. Selfridge, the members of this Institution recently visited the Selfridge Store Building in course of erection at 410, Oxford Street, London. The building is of the warehouse class, the frontage to Oxford Street being about 200 ft., and to Duke Street 175 ft.; it has three basements, and in addition to the ground storey there are four upper storeys, making eight storeys in all. There are nine passenger elevators, about 6 ft. square, and two freight elevators.

Institution of Civil Engineers (Students).—The first meeting of the session was held at the Institution on December 4th, when Mr. L. W. Atcherley read a paper on "The Design and Erection of a Plate Girder Bridge over the River Lee at Broxbourne." Dr. W. C. Unwin, F.R.S., who occupied the chair, asked those students who were in a position to give the time, to consider carefully Mr. Haldane's proposal to form a body of Reserve Royal Engineer officers, to be partly drawn from the students of the Institution of Civil Engineers. A sound and interesting military engineering training would be imparted, which he felt sure would be of value to the man himself, and in case of need, to his country.

At the Workmen's Club, Rochester, recently, Mr. J. Nicholson, of Chatham, gave an interesting lecture on "What is Electricity?"

Liverpool and District Electrical Association.—On Tuesday, December 8th, a paper was read by Mr. S. R. Gibbon, entitled "Electricity as Applied to Heating and Cooking." A small radiator on the new Electroyl system, manufactured by Messrs. Purcell & Nobbs, London, was also on exhibition, and we understand that it excited interest by reason of its very low current consumption, as compared with its heating capacity, and also owing to its novel construction.

Finsbury Technical College Old Students' Association.—The third annual dinner will take place on Tuesday, December 15th, at the Criterion Restaurant, at 7 p.m. for 7.30 o'clock, when the chair will be taken by Mr. P. V. McMahon, president of the Association. The electrical hon. sec. is Mr. E. W. Moss, 20, Huddleston Road, Tufnell Park, London, N.

Revocation of Patents.—Mr. T. Fletcher Wilson recently, in an instructive address to the Coventry Engineering Society upon the new Patents Act, dealt particularly with Section 27, to the effect that, at any time not less than four years after the date of a patent, any person may apply at the Patent Office for the revocation of the patent on the ground that the article or process forming the subject of the patent is manufactured or carried on exclusively or mainly abroad. He pointed out that the section turned principally on the words "mainly or exclusively," and although no definition was given as to what constituted carrying on a manufacture mainly or exclusively abroad, it was tolerably certain that if, to supply a demand in this country, 51 per cent. of the articles were manufactured abroad and imported, it would be held that the manufacture was carried on mainly abroad, and the patent for the article would probably be revoked. In the case of an article which had to pass through various processes in the course of its manufacture, if the majority of these processes were carried out abroad and the article was only finished in this country, the patent would, on that account, be in great danger of being upset. To pursue this point a little further, if the parts of a machine were manufactured abroad and only assembled in this country, it was more than likely that this would be held to be insufficient working of the invention in this country. The section was, of course, aimed chiefly at the foreigner, but it included the British inventor as well, as it was not uncommon in electrical matters such as telephones, commutators, &c., for a British patentee to have his invention manufactured abroad and to import it to this country. In such a case, unless the inventor had, before placing his business abroad, made every effort to get his invention made in this country, he would be in a very bad way, and liable any day to lose his patent. If, however, he had first of all made strenuous efforts to get his patent taken up and made in this country and had failed to do so, he would, at least, have some defence to put forward in case an application for revocation of his patent was lodged against him.

Private Bills.—Plans have been deposited in the Private Bill Office in respect of the following Bills:—Baker Street and Waterloo Railway, Central London Railway, Edgware and Hampstead Railway, North-West London Railway, Folkestone, Sandgate and Hythe Tramways, Gateshead and District Tramways, London County Council Tramways, Torquay and Paignton Tramways, and Wallasey Tramways. Plans have also been deposited in respect of the following Provisional Orders:—Bolton Corporation Tramways, Chesham Electric Lighting Extension, Chipping Norton Electric Lighting, Cleethorpes Electric Lighting, Greystones Electric Lighting, Herne Bay Electric Lighting, Hindhead and District Electric Lighting, Holsworthy Electric Lighting, Macclesfield Electric Lighting, Morecambe Corporation Tramways, Northampton Corporation Tramways, Portsmouth Corporation Tramways, Skelmorlie and Wemyss Bay Electric Supply, Southampton Electric Lighting, Staines Electric Lighting, Stourbridge Electric Lighting, Turton Electric Lighting, Walton-on-Naze Electric Lighting, and Whitworth Urban District Tramways.

Electro-Harmonic Society.—The next smoking concert of this Society is announced for Friday, December 18th, at the Holborn Restaurant. The programme includes songs by Messrs. Harold Wilde, Thorpe Bates, and the Æolian Gleemen. Among the other artists are Mr. J. H. Bull (operatic banjoist); Mr. Leonard Harris, who will give humorous recitations; and Mr. Fred. Hastings, who is to sing humorous songs. There will also be a humorous sketch by Mr. Astley Weaver, and character sketches from Dickens by Mr. Hewson Brown.

German Electrical Firms and Motor-Car Trade.—The Berlin correspondent of the *Financial News* says that the leading electrical concerns, such as the General Electric Co. and Siemens & Halske, have for many years had the ambition to enter the motor-car trade, but the idea has never got beyond the experimental stage. At last, however, a step in earnest has been taken, the Siemens-Schuckert Co. having taken over the Protos Works, which are so well known as having supplied the winning car in the New York-Paris race.

Appointment Vacant.—Mains superintendent for Hammersmith electricity department (£130).

West Ham Inquiry.—The L.G.B. Inspector having given notice of his intention to renew his demand for particulars of contracts on the resumption of the inquiry, the Council has resolved to decline to produce them.

Correction.—On p. 921 of our issue of November 27th, by an obvious misprint Mr. W. W. Lackie was made to say that 42,900 lb. of coal were required to warm up a Babcock boiler. The correct figure was 2,900 lb.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Gillingham (Kent) T.C. has increased the salary of Mr. H. R. G. Forster, mains superintendent, to £110, subsequently rising to £130.

On leaving for Melbourne, Australia, Mr. G. H. Cowper, of the Ilford U.D.C. electricity staff, has been presented by his colleagues with a dressing case.

A suitably inscribed watch has been presented to Mr. Wilfred Yorke by the Lot's Road power station staff of the Underground Electric Railways Co. of London, on the occasion of his leaving the company's service to take up a position with the Manchester Corporation.

Tramway Officials.—At a social meeting of the tramway employés at Falkirk (Mr. T. Hays, manager, presiding), Mr. A. Walton, late chief inspector, and Mr. J. A. Nolan were the recipients of presents on the occasion of their leaving the company's service.

General.—Mr. A. C. Weber, late of Messrs. Siemens Bros. & Co., Ltd., who has been on a short visit to this country from South Africa, has joined Messrs. W. H. Allen, Son & Co., Ltd., as their engineer and representative in South Africa. Mr. Weber sailed by the R.M.S. *Norman* on December 5th, and will have his headquarters in Johannesburg.

Mr. Alfred Slatter, consulting engineer, has removed his offices from 30 and 31, New Bridge Street, Ludgate Circus, E.C., to Caxton House, Westminster, S.W.

Mr. D. Walker has been appointed drawing office and record assistant to the Wimbledon electricity department. There were 71 applicants.

According to the *Times*, Mr. George Westinghouse jun., only son of Mr. George Westinghouse, of Pittsburg, U.S.A., is ill, and the date of his marriage to Miss Brocklebank, daughter of Sir Thomas Brocklebank, of Cumberland, has accordingly been postponed until he has recovered sufficiently to stand the ocean voyage.

Obituary.—Mr. Charles Payne, who had for many years carried on business as an electrical engineer and contractor, in Redwell Street, Norwich, died on December 2nd, at the age of 63 years.

CITY NOTES.

London Electrobus Co., Ltd.

In the financial history of this company we think we can see interesting evidence that the public is not out running after a new thing into which to put its money. Nor is it to be lured into a net by extravagant promises. Otherwise the large outlay upon advertising and circularising its new prospectuses would have produced more than a modest £76,929, the bulk of which is (or was) held by the directors and their friends. It is stated that 74,519 ordinary shares of £1 each and 9,641 five-shilling deferred have been issued for cash at par, and the assets represented by this capital consist of about a score of 'buses which, *when new*, can be bought at £700 each, plus the garage and its equipment. But we have so recently referred to the effort of the company to raise more capital that little need now be said concerning the prospectus that has been before the public this week. It will be remembered that a few weeks ago the directors announced that it was only by obtaining new capital, to put more 'buses on the streets, that they could make a profit on what was

already invested in the company. They accordingly offered £50,000 6 per cent. first mortgage debenture stock, at par, to the shareholders in the *first instance*, their application to be in by November 19th; and presumably these investors, labouring under their fill of Electrobus fare, did not come tumbling over one another in eagerness to secure the new bait, or this prospectus would not have found its way to the public, offering £40,000 out of an issue of £50,000. From the reception accorded to the prospectus by the daily Press, we doubt whether this last attempt has been any more successful than those that have preceded it. When the next electrical omnibus company comes along, we hope it will profit by the lessons learned by the existing undertaking and by the one that ended so disastrously some years ago.

Manx Electric Railway Co., Ltd.

Mr. A. G. Boscawen (Chairman) presided on Tuesday at the offices, 78, Cornhill, E.C., over a meeting of the above company. He moved the adoption of the report, which read as follows:—

"The gross receipts for the year ended September 30th, 1908, amount to £33,735, and the gross expenditure £16,734 = £17,001, plus £1,210 brought forward, making £18,211; deduct, debenture interest £9,000, interim dividend of 2¾ per cent. per annum on preference shares paid September 30th, 1908, £3,580, amount placed to reserve for special renewals £1,000, leaving £4,631, from which is deducted balance of preference share dividend due in respect of the year ended September 30th, 1908, £3,580, leaving a balance of £1,050. After payment, therefore, of the above-mentioned balance of dividend due on the preference shares, and after having placed a sum of £1,000 to reserve for special renewals, bringing this fund up to £5,157, there remains a balance of £1,050, which the directors propose carrying forward to next year. The capital expenditure has been £300. An expenditure of £185 has been made on additions to the workshop equipment, which were much needed for facilitating repairs to rolling stock on the company's premises. The net result of the year's working has not been as favourable as last year's; bad trade has prevailed, especially in Lancashire, which has affected the spending powers of the people, and from the middle of August to the end of the season, very unseasonable, rough weather was experienced in the Isle of Man, in consequence of which the arrivals in Douglas in September totalled 20,543 (or 32 per cent.) less than last year. Previous to August 15th the company was actually slightly ahead of last year's receipts. The passengers carried during the twelve months totalled 527,986, as compared with 546,666 during the previous twelve months, a decrease of 18,680. The receipts were £33,735, as against £35,345 in the previous year, whilst working expenses amounted to £16,734, as compared with £16,773, and the ratio of working expenses to receipts has been 49·6 per cent. in 1908, as compared with 47·4 per cent. in 1907."

The Chairman said they recognised that the year had been a disappointing one to both the board and the shareholders. The receipts showed a decrease of £1,600, which was accounted for entirely by a decrease in the passenger receipts. In fact, these were down £1,800, whilst goods and sundry receipts showed an increase of £200. They had done all they could to increase what he would call the permanent income of the line, and had been fortunate in securing a new mail contract with the Post Office, by which all stations, including Ramsay, would be served by the line. There had been several causes for the falling-off in the passenger receipts. One, of course, was the bad trade which had prevailed everywhere, and particularly in Lancashire, and which had affected the spending power of the public. Notwithstanding that, they were able to hold their own pretty well up to the middle of August. They then suffered from bad weather till the end of September, and, in fact, during the whole of that period they had only 15 days' fine weather, as compared with 30 during the same period in the previous year. All interests were affected, and the number of visitors to Douglas and Ramsay fell off. They carried fewer passengers by 18,680, and the whole of the shrinkage practically occurred after the middle of August. Another cause which to some extent had affected them was that the Exhibition in London drew a large number of people away from seaside resorts. The board took every step to decrease expenditure, but, as would be understood, it was impossible, when they had a summer service in operation and a staff engaged, to effect a large reduction all at once. They managed to reduce the passenger mileage by 8,767 miles, and by that means were able to carry the same number of passengers per train-mile as last year—viz., 1½. Here, however, reduced spending capacity showed itself, and their receipts fell from 21·51d. to 20·89d. per train-mile. Their expenses were practically the same as last year, and included a special expenditure of £164 for new boiler-tubes in the "Climax" boiler. They had added £1,000 to reserve for renewals, and that fund now stood at £5,157; and the board were convinced that they were pursuing a sound policy in continuing to build up that fund, having regard to the nature of their property and the plant they had to operate. In the bad results of last year they had suffered in common with other undertakings of a similar character. He had some figures showing the results of other undertakings whose accounts were made up at the same date as their own. He found that in the case of the Blackpool and Fleetwood Electric Tramways there was a falling off in 13 weeks of £2,182; in the Blackpool Corporation Tramways for 27 weeks a falling off of £1,896; in the Bournemouth Corporation Tramways for 26 weeks a falling off of £2,985; and in the Douglas Southern Electric Tramways a falling off of £600. They had continued their negotiations with the Corporation of Douglas with reference to the electrification of the tramways along the front, but so far the Corporation had rejected their proposals.

Sir W. H. Vaudrey seconded the motion, and the report was carried.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The directors' report for the year ending September 30th, 1908 shows, after provision for doubtful debts, a net profit of £52,946 Adding £49,034 brought forward, and deducting £12,500 interim dividend paid in July, there remains a disposable balance of £89,480. The directors recommend the distribution of a dividend of 15s. a share, free of income-tax, amounting to £37,500, making, with the interim dividend paid in July, a total payment of 10 per cent. for the year, and leaving £51,980 to be carried forward. The general business of the company shows an increase compared with the results of last year in certain lines; in others, however, there has been a falling off. The competition on the Continent in the tire trade has been severe and has adversely affected the profit of the French works. The prices of raw material, which had declined during the early part of the year, hardened again towards the close. The Palmer and Persan motor and bicycle tires still continue to grow in favour. This is especially so in the case of the Palmer tires. The electrical industry has been passing through a period of depression, from which the company have not escaped. There has been little doing in submarine cable work, but the company's steamers have had occasional employment during the year and are in an efficient condition. The works at Silvertown and Persan have been maintained in their usual state of efficiency. Since the termination of the financial year, the board, under the authority granted by the special resolution of the shareholders o June 30th last, has issued 12,500 preference shares, representing one-half the amount authorised. These shares are cumulative preference of £10 each, and bear interest at the rate of 5 per cent. payable half-yearly on January 1st and July 1st of each year, the first half-yearly payment falling due on July 1st, 1909. The board regret to state that the Hon. Henry Marsham died in July last. Mr. Marsham had been a member of the board for 21 years and the Chairman of the company for seven years; he was devoted to the company's interests and will be much missed at the board's councils.

Reduction of Capital.—*Trafford Power and Light Supply* (1902), *Ltd., and Red.*—A petition for reducing the capital from £150,000 to £80,920 is to be heard at Manchester on December 21st.

La Plata and Ensenada Tramways Co.—Meetings of the creditors and of the holders of the various securities of this company were to be held on 3rd inst. under order of the Court to consider a scheme of arrangement, under which it is proposed to form a new company, to be called the La Plata Electric Tramways Co., Ltd., or some similar name, with a capital of £450,000, consisting of 200,000 preference and 250,000 ordinary shares of £1 each. Fuller particulars appeared in the *Financial Times* on December 1st.

Prospectus.—*Stagbrook Rubber and Tea Estates, Ltd.*—The list is to close to-morrow in an issue of 55,000 shares of £1 each in this company, which is to acquire the Eldorado and Kokayar Rubber Estates and certain tea estates.

Mexican Companies.—A great deal has been appearing in the financial and other daily newspapers during this week concerning the controversy between the directors and the shareholders' committee of the Mexican Light and Power Co., Ltd., with reference to the contract between that company and the Mexican Tramways Co. The directors have set out their reasons for rejecting the proposal to lease to the tramways company on certain terms. A special general meeting of shareholders of the light and power company is to be held at Montreal on December 30th, and shareholders on this side have been asked to forward their proxies to "strengthen the hands of the directors in taking measures to protect the interests of the company."

Stratford-on-Avon Electricity Co., Ltd.—Mr. G. M. Bird presided at the annual meeting held recently, at which the accounts to December 31st, 1907, were presented, showing gratifying progress for the latter half of that year. A meeting will be held early in 1909 to pass the 1908 accounts.

Western Telegraph Co., Ltd.—A first quarterly dividend of 3s. per share for the year ending June, 1909, being at the rate of 6 per cent. per annum, has been declared.

Sao Paulo Tramway, Light and Power Co., Ltd.—A quarterly dividend of 2½ per cent. on the capital stock is payable on January 1st.

Canadian General Electric Co.—A dividend of 1¾ per cent. on the common stock has been declared for the three months ended 31st inst.

Globe Telegraph and Trust Co., Ltd.—The directors announce a quarterly dividend of 2s. per share on the ordinary shares.

MARKET QUOTATIONS.

Wednesday, December 9th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	28/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal)	per ton	£33 10	..
a ,, ,,	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£16	..
a Copper Sulphate	per ton	£21	..
a Lead, Nitrate	per ton	£23 10	10/- dec.
a ,, White Sugar	per ton	£23	..
a ,, Peroxide	per ton	£22	..
a Methylated Spirit	per gal.	2/6	..
a Potassium Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %)	per ton	£30	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	per lb.	9d.	..
a Potassium Cyanide	per lb.	7d.	..
a Shellac	per cwt.	95/-	5/- dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %)	per ton	£10 15	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	5d.	..
a ,, Cyanide (basis 100 %)	per lb.	9d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b ,, Wire, in ton lots	per ton	£112	..
b ,, Sheet, in ton lots	per ton	£120	..
n Babbitt's metal ingots	per ton	£50 to £140	..
c Brass (rolled metal 2" to 12") basis	per lb.	7¼d.	¼d. dec.
c ,, Tube (brazed)	per lb.	9d.	..
c ,, ,, (solid drawn)	per lb.	8d.	..
c ,, Wire, basis	per lb.	6¾d.	¼d. dec.
c Copper Tubes (brazed)	per lb.	9¾d.	..
c ,, ,, (solid drawn)	per lb.	9¼d.	..
g Copper Bars (best selected)	per ton	£77	..
g Copper Sheet	per ton	£77	..
g ,, Rod	per ton	£77	..
e ,, (Electrolytic) Bars	per ton	£66 10	..
e ,, ,, Sheets	per ton	£-3	..
e ,, ,, Rod	per ton	£71	..
e ,, ,, H.C. Wire	per lb.	8¾d.	..
f Ebonite Rod	per lb.	3/3	..
f ,, Sheet	per lb	3/-	..
m German Silver Wire	per lb.	1/6	..
h Gutta-percha, fine	per lb.	5/6 to 6/6	..
h India-rubber, Para fine	per lb.	5/- to 5/0½	dec.
i Iron Pig (Cleveland warrants)	per ton	48/6	6d. dec.
l ,, Wire, galv. No. 8, P.O.qual.	per ton	£14	..
g Lead, English Ingot	per ton	£13 10 to £13 12 6	dec.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 10	dec.
d Mica (in original cases) small	per lb.	6d. to 1/-	..
d ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, large	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/0½ to 1/2	..
p ,, rolled bars & rods	per lb.	1/2½ to 1/3½	..
p ,, ,, strip & sheet	per lb.	1/3 to 1/6	..
o Platinum	per oz.	84/-	..
c Silicium Bronze Wire	per lb.	9½d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	per ton	£130 to £131	£5 dec.
n ,, Wire, Nos. 1 to 16	per lb.	1/10	..
p White Anti-friction Metals— "White Ant" brand	per ton	£35 to £60	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£24 15	..

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Official Announcements re Companies.—The following companies are to be struck off the register in three months unless cause is shown to the contrary:—

Hemsworth Electricity Supply Co., Ltd.
Home Counties Electricity Supply Co., Ltd.
Hyde Electrical Manufacturing Co., Ltd.
Hyderabad Electric Light and Traction Co., Ltd.
Irish Electrical Agency, Ltd.
Kroeger Light Cure and Electro-Therapeutic Institutes, Ltd.
Schuls Turbines, Ltd.

Burmah Electric Tramways & Lighting Co., Ltd.—The accounts for the year ended July 31st show an excess of receipts over expenditure of £1,676, increasing the credit to revenue brought forward to £5,201. According to the *Financial News*, the sum of £5,000 was set aside as a depreciation fund and £201 carried forward.

STOCKS AND SHARES.

Tuesday Afternoon.

Calmer counsels have prevailed amongst those who were buying electricity supply shares, and the rise was checked by a fair amount of very judicious selling. The Stock Exchange as a whole is not in a particularly confident mood. Rumours have been rife that the King's indisposition is understated, and the Balkans business provides another cloud, to which dearer money contributes a greyish lining. In short, business is slack, so any kind of reasons must be sought to explain why people decline to buy anything but Christmas presents and mechanical toys.

The ostensible cause for the setback amongst shares of the electricity companies supplying London with current, was the unexpected hint that the L.C.C. has not abandoned definitely its intentions in the same direction. This gave pause to new buying, and the previous holders who had been waiting for the market to turn before they realised their shares, promptly sent in orders to sell. The effect was immediate, and the general list suffered recession, which extended to those cases where little or no selling took place. Of course the decline is almost negligible as compared with the dramatic rise which it followed. County of London and Westminster Ordinary fell 7s. 6d. each. St. James' lost 5s.; so did Brompton Ordinary, Metropolitan Preference and County Preference. Other falls did not exceed 2s. 6d. "A healthy reaction" observed some who had thought the market was travelling too fast for safety.

South Metropolitan Ordinary have risen to 2½, and a considerable increase in the company's business is expected, possibly as one result of the canvass recently made in part of the company's district to ascertain whether sufficient new private consumers can be obtained to make extension pay. Of the more outside shares, Hove gained ½ and Victoria Falls Power Preference ⅞, the latter due to the company having settled its threatened action with some of the principal South African mining concerns. Newcastle and District Debenture at 90 show a fall of 5½.

A rise of 6½ points lifted Electrical Development of Ontario 5 per cent. Gold bonds to 91½. Canadian General Common shares keep very steady at 111; the Preferred at 114 have hardly moved for several weeks past. Mexican Electric issues are lower, the falls varying from ½ to 2 points, Sir G. Drummond's statement failing to protect the Mexican Light and Power varieties. A small premium was quoted on the new Monterey Railway, Light and Power Debenture stock, but it was little more than a nominal price.

Sao Paulo Tramway shares are a lively spot; the price lost a point after being strong at 160. The rise is less on the dividend declaration of 2½ per cent. for the quarter than because an issue of new stock is understood to be in contemplation at a price securing a fine bonus to the proprietors. The 5 per cent. Debentures are 99½ *ex* the dividend paid last week. Rio shares at 77 and the bonds at 92½ have not greatly changed. Business in Mexico Tramways Common stock is active round about the improved price of 137½.

British Electric Traction Ordinary changed hands at 20s. on Monday. Calcutta Tramways Preference are faintly better, and there seems to be a more hopeful view taken of the political situation in India. Bombay Electricity Supply and Trams 6 per cent. Preference shares are 10½, the fraction representing the premium on the nominal value of the shares. The 4½ per cent. Debenture stock stands at 95, with a half-year's interest included in the price. Rangoon Electric Tramway and Supply 6 per cent. Preference shares of £5 each stand at 5½, and the 4½ per cent. Debenture stock, also carrying six months' interest, at par. Madras Electric Trams 5 per cent. Debenture stock is supposed to be 93½.

The Electrobus Company has been inviting subscriptions for more capital. In several respects the prospectus failed to attract us. One thing the Electrobus has done to win the Londoner's regard; it has forced the London General combination to lower the fares, but this, unkindly enough, must be included amongst other reasons why we consider the stock best left alone.

Few of the Home Railway works present a hopeful appearance, and the Tube descriptions are no better than the majority of the others. City and South London Ordinary continues to droop, and another point loss this week has reduced the price to 30. Central London Deferred advanced 1, Metropolitans ½, both of these being 50 per cent. of falls suffered in the previous week. Districts hardened to 13. It is proposed to make a moving platform for the use of passengers between the British Museum station on the Central London, and Holborn station on the Piccadilly Tube. Great Northern and City shares shrivelled to 10s. Underground Electric Railways of London issues are flat, but there is no change in London United Tramways Preference or Debenture, in spite of the company's cool endeavour to link up with the L.C.C. tramway system.

From the notices sent out, it is to be inferred that the recent new issue of prior lien bonds by the Brush Electrical Engineering Company has been taken by the public. It would, however, be of interest to know whether any part of the stock were "allocated" to underwriters, and, if so, upon what terms. A fall of 3 in the 4½ per cent. First Debenture stock leaves the price at 67½. British Insulated Ordinary rose ½, and British Aluminium 6 per cent. Preference regained the recent fall of a similar sum. Dick, Kerrs are better again. Other changes in the manufacturing group embrace a fall of 5s. in Callenders, which are now 9½, and a rise of 10s. in Henleys, which makes the latter 12.

Telegraph and Telephone securities incline somewhat to the dull side where there are any changes at all. And they are not many. Eastern Extensions took a slight turn for the better, although Eastern Telegraph Ordinary stock fell 1. Anglo-American Deferred dropped, on speculators' sales. Globe Telegraph and Trust Preference eased off another half-a-crown. Indo-Europeans again lost 20s., and Marconis are unchanged at ⅞. National Telephone Deferred is ½ lower, and American Telephone capital stock fell a point, the company's 4 per cent. bonds gaining an equal amount.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Dec. 1st.	Closing Quotations Dec. 8th.	Business done week ended Dec. 8th, 1908. Highest.	Lowest.	Rise + or Fall −	Present Yield per cent.
							£ s. d.	£ s. d.				£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2¼ — 2½	2¼ — 2½	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	5 %	5 %	5 %	90 — 93	92 — 95	..	..	+2	5 5 8
$131,561,400	American Telephone & Telegraph, Cap. Stock	$100	7¼%	7¼%	8 %	8 %	133 —136	132 —135	..	..	−1	5 18 6
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	94 — 96	96 — 98	..	..	+2	4 1 8
598,180	Anglo-American Telegraph	Stock	2¾%	3½%	3¾%	3½%	58 — 61	58 — 61	59	58	..	5 14 9
3,200,910	Do. do. do. 6 % Pref.	Stock	5½%	6 %	6 %	6 %	102 —106	102 —106	102½	102	..	5 15 11
3,200,910	Do. do. do. Deferred	Stock	Nil	½%	1¾%	1 %	17 — 17½	16½ — 16¾	17	16½	— ½	5 18 9
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8½	8 — 8½	..	..	..	4 14 1
2,388,376	Commercial Cable Stng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87 — 89	87 — 89	88½	..	−1½	4 9 11
16,000	Cuba Telegraph	10	5 %	5 %	5 %	6 %	7½ — 8½	7½ — 8½	..	..	..	7 1 2
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½ — 17½	16½ — 17½	..	..	..	5 15 11
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref.	10	10 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	3 14 10
60,710	Direct United States Cable	20	3½%	4½%	4½%	4½%	13 —13½	13 — 13½	..	..	..	6 5 11
50,900	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,900, R.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	130 —135	129 —134	132½	129½	−1	5 4 6
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	83½— 85½	83½— 85½	84½	83½	..	4 1 10
1,896,706	Do. 4 % Mort. Deb. Stock. Red.	Stock	4 %	4 %	4 %	4 %	103½—105½	103½—105½	104½	103½	..	3 17 8
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	11½ — 11¾	11½ — 12	11⅝	11½	+ ⅛	5 16 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
269,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	..	3 18 10
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	5½%	10½— 10¾	10½— 10¾	10¾	10⅝	..	5 11 2
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13 — 13½	12½— 13⅛	13⅛	13	— ⅛	4 9 9
150,000	Great Northern Telegraph, of Copenhagen	10	24 %	24 %	20 %	20 %	30 — 32	30 — 32	31½	30½	..	6 5 0
19,600	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,900, Red.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	55 — 58	54 — 57	56½	55	−1	6 11 7
$41,380,400	Mackay Companies Common	$100	1 %	2 %	3½%	4 %	74 — 82	78 — 82	..	..	..	4 17 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	70 — 74	70 — 74	..	..	..	5 8 1
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅛— ⅜	⅛— ⅜	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	6 %	¾— 1	¾— 1	18/9	..	..	6 9 0
86,492	Do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	⅝— ¾	⅝— ¾	..	..	..	6 9 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108½ 110½	108½—110½	110	109	..	5 9 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	5 %	6 %	116½—118½	116 —118	117⅝	11 7	— ⅛	5 1 8
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½— 11½	10½— 11½	11½	..	..	5 5 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10½— 11½	10½— 11½	..	..	..	4 8 11
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛— 5⅛	5⅛— 5⅛	6⅛	5⅛	..	4 7 1
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	98⅛	98	..	3 10 4
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	101 —103	101 —103	102	..	..	3 17 8
179,319	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6½%	7 %	7 %	8 %	1½— 1¾	1½— 1¾	..	..	..	5 16 4
50,000	Do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1¼— 1½	1¼— 1½	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock	100	..	4 %	4 %	4 %	90 — 92	90 — 92	90	..	..	4 7 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 4
11,539	Reuter's	8	5 %	5 %	5 %	5 %	7 — 8	7 — 8	..	..	..	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	4½%	100½—102½	100¾—102½	..	..	..	4 7 10
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
100,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅝— 7⅛	6⅝— 7⅛	7	..	..	5 16 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	5⅛	5	..	4 10 11
80,008	W. Coast of America, 1 to 80,000 & 80,001 to 83,008	2½	Nil	Nil	Nil	2½%	1¼— 1½	1¼— 1½	..	..	..	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
307,980	Western Telegraph, Ltd., Nos. 1 to 307,980	10	7 %	7 %	7 %	7 %	12⅜— 13⅛	12⅜— 12⅝	12⅝	12⅜	..	5 5 8
800,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅛— ¼	⅛— ¼	10/-	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	8 %	6 %	7⅛— 8⅛	7⅛— 8⅛	..	..	..	7 7 8
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	£2 6	7⅛— 8⅛	7⅛— 8⅛	..	..	..	7 11 5
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	5 %	101½—103½	101½—103½	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

820,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	8 %	9 %	9⅛— 9⅜	9⅛ — 9⅜	9 5/16	9 5/16	..	4 16 0
260,007	Do. 6 % Cum. Prefs., 1 to 260,007	5	5½%	5½%	5½%	5½%	6⅜— 6⅝	6⅜— 6⅝	6⅜	6⅜	..	6 4 4
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	143 —148	143 —148	..	..	..	4 2 2
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock	100	5 %	5 %	5 %	5 %	102 —105	102 —105	102½	..	..	4 15 3
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	20 %	20 %	3 1/16— 4 1/16	3 1/16— 4 1/16	81/6	79/4½	..	4 18 2
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/16	1 1/16— 1 1/16	..	..	..	5 18 10
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	1½— 2	1½— 2⅛	37/6	..	+ ⅛	16 9 4
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	2½— 3½	2½— 3½	60/-	57/6	+ ½	10 0 0
40,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3½— 4	3½— 4½	89/9	89/4½	+ ½	7 1 2
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¾— 4½	3¾— 4½	76/8	..	+ ⅛	4 8 11
48,478	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	105 —108	105 —108	..	..	..	4 12 7
800,000	Do. do. 5½ % Loch Leven Debs.	100	..	..	5½%	5½%	98½—100½	98½—100½	..	..	..	5 9 5
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	8 %	134 —138	134 —138	135½	134½	..	5 15 11
400,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	116 —120	116 —120	117½	116½	..	4 11 4
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —109	107½—109½	109	108⅝	+ ⅛	4 11 9
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	101 —103	101 —103	103⅜	..	..	10 17 6
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 12
188,801	British Electric Traction	10	6 %	3 %	Nil	Nil	1⅝— 1⅞	1⅝— 1 15/16	20/-	..	..	Nil.
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %	3½— 4½	3½— 4½	80/-	76/10½	..	8 1 2
1,478,658	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	5 %	91 — 96	91 — 96	92	91	..	5 4 0
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	73 — 75	73 — 75	..	..	..	6 0 1
100,000	British Insulated and Helsby Cables	5	8 %	8 %	10 %	10 %	6½— 6⅞	6½— 7	..	..	+ ⅛	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅜	6 — 6⅜	..	..	..	4 14 1
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
208,440	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	40 — 45	40 — 45	..	..	..	8 17 10
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	⅝— 1¼	⅝— 1¼	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	2½%	Nil	Nil	..	..	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	Nil	..	..	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	68 — 73	65 — 70	66	65½	−3	6 8 7
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	49 — 53	49 — 53	..	..	..	8 9 10
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	8 %	6 %	4½— 5	4½— 5	97/6	95/-	..	6 0 0
45,404	Do. 5 % Cum. Pref., Nos. 1 to 29,320	5	..	5 %	5 %	5 %	4⅝— 5⅛	4½— 5½	5 5/16	..	+ ⅛	4 15 3
850,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
85,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	15 %	9½— 10½	9 — 10	9½	9¼	+ ¼	7 10 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5½— 6½	5½— 6½	..	..	..	5 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	107½—109½	107½—109½	..	..	..	4 2 2
491,222	Cape E Trams., 1 to 491,222	1	5 %	Nil	Nil	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	12 %	1¼— 1⅝ xd	1⅜— 1⅝	91/10½	81	..	7 14 10
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	106 —107	106 —107	..	..	..	4 6 11
1,998,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	3 %	64 — 66	64 — 66	65⅜	65	..	4 10 11
558,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	85⅛	84½	..	4 13 0
558,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	49 — 51	50 — 52	51	..	−1	3 16 11
1,480,000	City and South London Railway	Stock	3½%	1½%	3½%	3½%	30½— 31½	30½— 30½	30½	29½	−1	6 19 4

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Shares.	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Dec. 1st.	Closing Quotations Dec. 8th.	Business done week ended Dec. 8th, 1908. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	*	2½%	2½%	5 %	5 %	1⅝ — 1¾	1⅝ — 1¾	..	..	..	10 0 0
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	98 —101	98 —101	..	..	..	4 19 0
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	+ 3/32	7 2 10
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	22/6	..	..	5 1 1
276,860	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6%	11½ — 12½	11½ — 12½	..	..	..	5 4 0
60,000	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	2½%	4½%	4½%	4½%	⅛ — ¼	⅛ — ¼	..	..	..	16 12 6
17,189	Do. "A" shares, 9l.—017,189	5	2½%	4½%	4½%	4½%	1¾ — 2¼	1¾ — 2¼	..	..	..	8 6 9
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	76 — 79	76 — 79	..	..	..	5 1 3
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	86 — 89	86 — 89	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	4 %	Nil	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1 — 1¼	1 — 1¼	..	..	..	9 6 8
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	6¾ — 7¼	7 — 7¼	..	..	+ ¼	6 18 4
200,000	Do. do. 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	84 — 88	84 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	¾	¾ — 1	½ — ¾	..	..	— ¼	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10¾	10½ — 10¾	12⅛	..	..	6 10 8
60,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	15%	11 — 12	11½ — 12½	12½	..	+ ⅜	6 0 0
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5¼	5 — 5¼	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105 —107 xd	105 — 107	..	..	..	4 4 1
60,000	India-Rubber, Gutta-percha & Telegraph Works.	10	5 %	10%	10 %	10 %	16⅜ — 17⅜	16⅜ — 17⅜	..	..	..	8 1 7
87,500	†Liverpool Overhead Railway, Ord.	10	1½%	Nil	Nil	½	1 — 1½	1 — 1½	..	..	..	4 7 6
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	11 2 3
600,070	London United Trams. (1901), 1 to 50,007	10	6 %	8 %	8 %	8 %	6½ — 6¾	6½ — 6¾	..	..	..	4 8 11
299,930	Do. do. 50,008 to 100,000	10	6 %	8 %	8 %	8 %	6½ — 6¾	6½ — 6¾	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	4½ — 5⅛	4½ — 5⅛	96/3	..	..	9 1 10
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 72	67 — 72	..	..	..	5 11 1
6,782,062	Metropolitan Consolidated	100	3½%	2½%	1	½	35 — 36	35½ — 36½	36¼	35	+ ½	1 7 5
2,640,314	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	67 — 69	67 — 69	70	67⅞	..	3 19 9
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	12½ — 13	12¾ — 13¼	13	..	+ ¼	Nil
814,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	Nil	⅝ — ¾	⅝ — ¾	1/-	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅝ — ¾	⅝ — ¾	15/9	..	..	5 19 5
822,800	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 95	94½	92½	—1	4 14 9
245,500	Potteries E. Trc.	1	5 %	4 %	4 %	4 %	¼ — ⅜	¼ — ⅜	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	¾ — 1	¾ — 1	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	90 — 93	90 — 93	..	..	..	4 14 9
87,850	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	17½%	101½ —103½	101½ —103½	..	..	..	6 7 4
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	93 — 94	92½ — 93½	98⅝	92⅞	— ⅛	8 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	74 — 75	73 — 75	74¼	73½	— ⅛	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	..	19½ — 20½	18 — 20	19½	19	—1	..
4,800,000	Do. do. 6% Income Bonds	..	..	..	..	..	⅛ — ¼	⅛ — ¼	..	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	Nil	Nil	10 %	2 — 2¼	2⅛ — 2¼	..	..	..	10 0 0
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	Nil	Nil	..	6 %	68 — 72	68 — 72	69½	..	..	10 8 8
246,404	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %						5 11 1

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	5½%	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	5 11 5
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	94 — 98	94 — 98	..	..	..	4 10 0
30,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10%	10 %	8½ — 9	8½ — 8⅝	8⅛	8½	— ¼	5 14 3
9,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —101 xd	98 — 101	..	..	— ½	3 19 8
80,000	Charing Cross and Strand Electricity Supply	5	8 %	5 %	5 %	5 %	4¼ — 4⅜	4¼ — 4⅜	92/9	87/6	..	5 5 3
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Pri.	5	4½%	4½%	4½%	4½%	8¾ — 4⅜	8¾ — 4⅜	..	..	..	5 16 2
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 1 8
49,486	Chelsea Electricity Supply, Ord.	5	6 %	6 %	4½%	4½%	4 — 4¼	3¾ — 4⅜	87/6	77/6	— ⅛	5 3 3
175,000‡	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅛ — 10⅝	10 — 10½	10½	10⅛	— ⅛	5 14 3
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12½ — 13	12¾ — 13	12⅞	..	..	4 12 4
400,000‡	Do. 5 % Db. Stk., Scrip, (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	123 —125	123 —125	..	..	..	4 0 0
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	102	101½	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	£3 7 0	4	4	2 %	2¾ — 3	2⅞ — 3	..	..	..	3 6 8
60,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3½ — 4	3½ — 4	..	..	..	6 5 9
220,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	..	99 —101	99 —101	..	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	5 %	8⅝ — 9⅛	8⅝ — 8⅞	8⅞	8½	— ⅛	5 14 3
50,026	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11½	10⅜ — 11	10⅛	10⅜	— ¼	5 9 1
400,000‡	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	97 —100	97 —100	99½	..	..	4 10
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	4	Nil	Nil	⅛ — 5/16	5/16 — ⅜	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	3 %	Nil	⅜ — ½	⅜ — ½	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	62 — 65	62 — 65	..	..	..	6 18 6
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	..	84 — 86	84 — 86	86¾	84½	..	..
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅞ — 5¼	4⅞ — 5¼	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	5 %	5 %	5 %	5 — 5¼	5 — 5¼	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 — 100	97 —100	..	..	..	4 10 11
15,000	Hove, 1 to 15,000	5	8½%	9 %	9 %	8½%	6⅛ — 6½	6⅛ — 6⅝	6½	3/8	+ ⅛	6 8 4
$1,325,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	..	95 — 96	95 — 96	96	3/8	..	..
21,000	Kensington and Knightsbridge Electric Ord.	5	12 %	10 %	10 %	10 %	7⅛ — 8⅛	7⅜ — 8⅛	8	7 15/16	+ ⅛	6 1 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4	4	4	4	94 — 97	94 — 97	..	..	..	4 2 6
111,000	London Electric Supply Corporation, Limited, Ord.	3	3	4	4	2½	1½ — 1⅞	1½ — 1⅞	35/-	..	..	4 0 0
70,000	Do. do. do 5 % Pref.	5	6	6	6	6	4⅝ — 5¼	4⅝ — 5¼	98/-	97/6	..	5 14 3
574,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4	4	4½%	4½%	91 — 94	91 — 94	..	..	..	4 15 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	10	8	6½%	5⅜ — 5⅞	5⅜ — 5⅝	5⅞	5½	— ⅛	5 13 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5⅛	4⅝ — 5⅛	98/9	96/-	— ⅛	4 7 10
220,000‡	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	109½	..	..	4 1 10
248,000‡	Do. 3¾ % Mort. Deben. Stock Redem.	Stock	3¾%	3¾%	3¾%	3¾%	85 — 88	85 — 88	..	..	..	4 2 4
$5,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	86 — 87	84 — 85	87	86	—2	5 17 8
$13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	..	76½ — 77½	76 — 77	77⅛	74⅞	..	..
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	..	106½—108½	103½—105½	106½	104½	—3	..
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	..	89½ — 90½	87 — 88	90⅛	87⅛	—2½	..
350,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	8 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	7 16 1
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	6 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 10 11
10,852	Notting Hill Electric Lighting	10	7 %	7½%	7½%	7½%	11⅜ — 12⅜	11⅜ — 12⅜	12	..	..	5 17 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	5⅝ — 6¼	5⅝ — 6¼	..	..	..	5 12 0
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	..	2½%	..	1⅝ — 1¾	1⅝ — 1¾	20/9	24/6	..	..
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6	6	6	6	1⅝ — 1¾	1⅝ — 1¾	20/6	20/-	..	..
194,684	Do. do. 5% Deb. Stk. Red.	100	5	5	5	..	100 —103	100 —103	101¼	..	..	4 17 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	12½%	10 %	10 %	6⅞ — 9⅜	8⅝ — 9¼	9¼	8⅜	— ¼	5 9 7
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 13 4
150,000‡	Do. do. 3½ % Deb. Stock Red.	100	3½%	3 %	3½%	3½%	87 — 91	87 — 91	89	81½	..	3 16 11
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	Nil	Nil	7/8 — 15/16	7/8 — 15/16	..	..	..	Nil
46,700	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1
65,000	South London Electricity Supply, Ord.	5	4 %	4 %	3 %	4 %	2¾ — 2⅞	2⅝ — 3	58/9	57/6	+ ¼	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	2½%	2½%	2½%	⅜ — ½	⅜ — ½	..	..	..	3 6 8
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 3/32 — 1 5/32	1 3/32 — 1 5/32	23/3	..	..	5 16 8
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	1 — 1	1 — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅞ — 2	1⅞ — 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 83	80 — 83	81½	..	..	5 8 5
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	..	⅜ — ½	⅜ — 7/16	17/6	13/3	+ 3/32	..
110,000	Westminster Electric Supply, Ord.	5	14 %	13 %	12 %	10 %	8⅝ — 8¾	8½ — 8⅝	⅝	8¼	— 3/32	5 14 3
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	5 %	4½%	4½%	5⅛ — 5⅜	5 — 5⅛	5 5/16	5 1/16	— ⅛	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

Bank rate of Discount 2½ per cent., May 28th, 1908.

ELECTRICAL TRADE STATISTICS OF SWITZERLAND IN 1907.

The following figures, showing the imports and exports of electrical goods into and from Switzerland during the year 1907, are taken from the recently issued trade statistics; details for 1906 are added for purposes of comparison, and notes of any increases or decreases are given. All figures are in francs:—

IMPORTS.

	1906.	1907.	Increase or decrease.
Carbons for Electric Lights.—From			
Germany ...	87,000	92,000	+ 5,000
Austria ...	6,000	4,000	— 2,000
France ...	63,000	47,000	— 16,000
Other countries	1,000	1,000	—
Total ...	157,000	144,000	— 13,000
Electrodes not mounted.—From			
Germany ...	159,000	181,000	+ 22,000
Austria ...	22,000	35,000	+ 13,000
France ...	169,000	178,000	+ 9,000
Other countries	—	4,000	+ 4,000
Total ...	350,000	398,000	+ 48,000
Iron Plates for Dynamos, &c.—From			
Germany ...	2,046,000	2,369,000	+323,000
Austria ...	84,000	173,000	+ 89,000
France ...	103,000	35,000	— 68,000
Great Britain	602,000	768,000	+166,000
Other countries	3,000	36,000	+ 33,000
Total ...	2,838,000	3,381,000	+543,000
Rails and Sleepers.—From			
Germany ...	6,413 000	7,514,000	+1,101,000
France ...	177,000	338,000	+ 161,000
Belgium ...	26,000	407,000	+ 381,000
Other countries	10,000	1,000	— 9,000
Total ...	6,626,000	8,260,000	+1,634,000
Electric Cables.—From			
Germany ...	611,000	477,000	—134,000
Austria ...	25,000	120,000	+ 95,000
France ...	20,000	14,000	— 6,000
Italy	67,000	76,000	+ 9,000
Belgium ...	—	24,000	+ 24,000
United States	—	13,000	+ 13,000
Other countries	20,000	11,000	— 9,000
Total ...	743,000	735,000	— 8,000
Boilers, &c.—From			
Germany ...	751,000	1,004,000	+253,000
France ...	180,000	264,000	+ 84,000
Belgium ...	2,000	22,000	+ 20,000
Great Britain	83,000	120,000	+ 37,000
United States	15,000	71,000	+ 56,000
Other countries	15,000	26,000	+ 11,000
Total ...	1,046,000	1,507,000	+461,000
Dynamo-Electric Machinery and Transformers.—From			
Germany ...	1,069,000	1,476,000	+407,000
Austria ...	3,000	12,000	+ 9,000
France ...	90,000	46,000	— 44,000
Italy	55,000	18,000	— 37,000
Belgium ...	15,000	15,000	—
Great Britain	14,000	2,000	— 12,000
Other countries	18,000	4,000	— 14,000
Total ...	1,264,000	1,573,000	+309,000
Hydraulic and Wind Motors and Pumps.—From			
Germany ...	600,000	698,000	+ 98,000
France ...	36,000	103,000	+ 67,000
Italy	8,000	34,000	+ 26,000
Great Britain	10,000	8,000	— 2,000
Other countries	14,000	9,000	— 5,000
Total ...	668,000	852,000	+184,000
Gas, Petroleum, Benzine, &c., Motors.—From			
Germany ...	799,000	277,000	—522,000
France ...	42,000	43,000	+ 1,000
Italy	4,000	21,000	+ 17,000
Great Britain	5,000	8,000	+ 3,000
United States	28,000	14,000	— 14,000
Other countries	3,000	1,000	— 2,000
Total ...	881,000	364,000	—517,000
Accumulators and Accumulator Plates, and parts.—From			
Germany ...	140,000	255,000	+115,000
Austria ...	146,000	239,000	+ 93,000
France ...	96,000	86,000	— 10,000
Other countries	10,000	11,000	— 1,000
Total ...	392,000	591,000	+199,000
Electric Meters.—From			
Germany ...	810,000	942,000	+132,000
France ...	81,000	89,000	+ 8,000
Italy	20,000	16,000	— 4,000
Great Britain	16,000	22,000	+ 6,000
United States	54,000	12,000	— 42,000
Other countries	2,000	5,000	+ 3,000
Total ...	983,000	1,086,000	+103,000
Telegraph and Telephone Apparatus.—From			
Germany ...	257,000	291,000	+ 34,000
Austria ...	12,000	4,000	— 8,000
France ...	14,000	18,000	+ 4,000
Belgium ...	27,000	74,000	+ 47,000
Great Britain	6,000	176,000	+170,000
Sweden ...	2,000	18,000	+ 16,000
Other countries	7,000	9,000	+ 2,000
Total ...	325,000	590,000	+265,000
Electric Arc Lamps.—From			
Germany ...	313,000	360,000	+ 47,000
France ...	11,000	12,000	+ 1,000
Other countries	1,000	3,000	+ 2,000
Total ...	325,000	375,000	+ 50,000
Electric Incandescent Lamps.—From			
Germany ...	312,000	264,000	— 48,000
Austria ...	24,000	25,000	+ 1,000
France ...	100,000	102,000	+ 2,000
Other countries	4,000	9,000	+ 5,000
Total ...	440,000	400,000	— 40,000

EXPORTS.

	1906.	1907.	Increase or decrease.
Electric Light Carbons.—To			
Italy	31,000	35,000	+ 4,000
Great Britain	8,000	38,000	+ 30,000
Germany ...	11,000	10,000	— 1,000
France ...	3,000	4,000	+ 1,000
Other countries	2,000	10,000	+ 8,000
Total ...	55,000	97,000	+ 42,000
Boilers, &c.—To			
Germany ...	320,000	600,000	+280,000
France ...	234,000	247,000	+ 13,000
Italy	422,000	414,000	— 8,000
Russia ...	121,000	100,000	— 21,000
Greece ...	—	127,000	+127,000
Egypt ...	297,000	154,000	—143,000
Japan... ...	19,000	89,000	+ 70,000
Other countries	217,000	212,000	— 5,000
Total ...	1,630,000	1,943,000	+313,000
Dynamo-Electric Machines and Transformers.—To			
Germany ...	2,145,000	2,653,000	+508,000
Austria ...	738,000	778,000	+ 40,000
France ...	2,902,000	4,176,000	+1,274,000
Italy... ...	3,812,000	5,310,000	+1,498,000
Belgium ...	337,000	256,000	— 81,000
Great Britain..	345,000	111,000	—234,000
Sweden ...	300,000	667,000	+367,000
Spain... ...	1,666,000	745,000	—921,000
Egypt ...	137,000	363,000	+226,000
Russia ...	808,000	472,000	—336,000
Norway ...	216,000	435,000	+219,000
Columbia ...	8,000	142,000	+134,000
Brazil... ...	140,000	143,000	+ 3,000
Argentina ...	198,000	134,000	— 64,000
Other countries	942,000	1,048,000	+106,000
Total ...	14,694,000	17,433,000	+2,739,000
Electric Cables.—To			
Germany ...	283,000	618,000	+335,000
France ...	31,000	36,000	+ 5,000
Spain... ...	25,000	13,000	— 12,000
Other countries	57,000	44,000	— 13,000
Total ...	396,000	711,000	+315,000
Hydraulic and Wind Motors, and Pumps.—To			
Germany ...	1,178,000	1,060,000	—118,000
France ...	571,000	1,823,000	+1,252,000
Italy	588,000	691,000	+103,000
Great Britain..	83,000	333,000	+250,000
Norway ...	164,000	259,000	+ 95,000
Spain... ...	572,000	172,000	—400,000
Japan... ...	407,000	243,000	—164,000
Mexico ...	280,000	281,000	+ 1,000
Brazil... ...	97,000	552,000	+455,000
Other countries	1,007,000	1,043,000	+ 36,000
Total ...	4,947,000	6,457,000	+1,510,000
Gas, Petroleum, and Benzine Motors.—To			
France ...	1,076,000	1,454,000	+378,000
Italy	603,000	748,000	+145,000
Great Britain..	165,000	296,000	+131,000
Russia ...	115,000	244,000	+129,000
Roumania ...	190,000	843,000	+653,000
Egypt ...	279,000	191,000	— 88,000
Brazil... ...	102,000	335,000	+233,000
Chile	172,000	132,000	— 40,000
Australia ...	108,000	109,000	+ 1,000
Other countries	1,481,000	1,421,000	— 60,000
Total ...	4,291,000	5,773,000	+1,482,000
Accumulators and parts.—To			
Germany ...	19,000	15,000	— 4,000
Austria ...	4,000	13,000	+ 9,000
France ...	31,000	62,000	+ 31,000
Italy	7,000	24,000	+ 17,000
Spain	5,000	2,000	— 3,000
Australia ...	5,000	2,000	— 3,000
Other countries	8,000	15,000	+ 7,000
Total ...	79,000	133,000	+ 54,000
Electric Meters.—To			
Germany ...	61,000	55,000	— 6,000
Austria ...	14,000	25,000	+ 11,000
France ...	38,000	97,000	+ 59,000
Italy	50,000	74,000	+ 24,000
Great Britain..	9,000	80,000	+ 71,000
Spain	80,000	17,000	— 63,000
Servia and Bulgaria ...	30,000	10,000	— 20,000
Brazil... ...	4,000	13,000	+ 9,000
Other countries	12,000	13,000	+ 1,000
Total ...	298,000	384,000	+ 86,000
Telegraph and Telephone Apparatus.—To			
Italy	32,000	35,000	+ 3,000
Russia ...	31,000	34,000	+ 3,000
Africa... ...	—	13,000	+ 13,000
Other countries	19,000	20,000	+ 1,000
Total ...	82,000	102,000	+ 20,000
Electric Arc Lamps.—To			
Germany ...	6,000	4,000	— 2,000
France ...	14,000	7,000	— 7,000
Other countries	2,000	12,000	+ 10,000
Total ...	22,000	23,000	+ 1,000
Electric Incandescent Lamps.—To			
Germany ...	127,000	153,000	+ 26,000
Austria ...	57,000	37,000	— 20,000
France ...	35,000	37,000	+ 2,000
Italy	169,000	162,000	— 7,000
Great Britain..	60,000	22,000	— 38,000
Sweden ...	46,000	19,000	— 27,000
Norway ...	11,000	46,000	+ 35,000
Egypt ...	18,000	11,000	— 7,000
Other countries	65,000	141,000	+ 76,000
Total ...	588,000	628,000	+ 40,000

BOOK NOTICES.

Esperanto Self-Taught. By W. W. Mann. London: Marlborough and Co. Price 1s.—Whatever may be one's views as to the practicability of establishing a universal language, one cannot but admire the energy and enthusiasm with which its advocates labour in the cause, and the excellent books which they produce in furtherance of their purpose. Esperanto, we are informed, is already taught in many of the L.C.C. schools, and is included by several well-known examining bodies in their syllabuses. The work before us is, as its name implies, a manual for the solitary learner; it includes vocabularies relating to numerous subjects, conversational phrases and grammar, &c., with phonetic pronunciation, and appears to be admirably adapted for its purpose.

Tin-plate Work. By R. H. Clarke. London: Technical Publishing Co. Price 1s. 6d. net.—This is a very practical hand-book—the first of a series—for students of the City and Guilds Institute in manual training, and gives detailed instructions on all kinds of tin-plate work, from simple articles to quite complicated designs. Incidentally the student learns a good deal of solid geometry, and in many instances he is assisted by half-tone blocks from photographs of the actual processes. Next to actual demonstration, this manual should prove a most useful means of instruction, especially as it is essentially accompanied by the actual performance of the various processes.

Ion.—This is the brief title of a new "Journal of Electronics, Atomistics, Ionology, Radioactivity and Raumchemistry," of which the first number has recently appeared. It is published at 16, Heathfield Gardens, Turnham Green, W., price 6s. net per single copy, and will appear monthly. The newcomer is intended to be the Physico-Chemical Journal of Britain, though its rather eccentric sub-title hardly conveys this idea, and there is a marked Teutonic flavour about both the title and the contents; the journal is, in fact, printed in Germany, and half the contents are by German authors. The two principal articles are by Mr. F. Soddy and Prof. Joly, of whom the former is announced on the cover as joint-editor with Mr. C. H. Walter; since the appearance of the issue, however, Mr. Soddy has repudiated his connection with the journal entirely.

Steam and the Steam Engine. By A. Jamieson, M.Inst.C.E. London: Chas. Griffin & Co. Price 3s. 6d. This is the twelfth edition of Prof. Jamieson's "Elementary Manual," a statement which almost renders comment needless. The 1907 and 1908 Examination Papers of the Board of Education have been added, and errors corrected; otherwise, the book does not greatly differ from the preceding edition. The characteristics of Prof. Jamieson's books are lucidity of explanation and clearness of illustration; the author minutely defines all quantities and gives numerous worked examples of calculations, giving the beginner every possible assistance in his work. We do not like to see Joule's equivalent still stated as 772, and we think the author's calculations to seven significant figures unnecessarily exiguous, and, indeed, misleading in their apparent accuracy. Some of the half-tone illustrations are capable of great improvement—that of the *Turbinia*, for instance, p. 313. A more open screen is necessary, to enable half-tones to come up well on the paper used.

El Porvenir de la Industria Electrica en el Peru. By Prof. E. Guarini. Vol. 2. Lima: Tipografia "El Peru." Price 3 sols.—Whatever one may think of the "future of the electrical industry in Peru," one cannot refrain from admiring the industry of Prof. Guarini, who, ever since he was appointed at the Government schools, has not ceased to investigate and to publish abroad the natural resources and possibilities of that and the adjoining countries. We hope that his indefatigable efforts will have their due reward, and that Peru and Chile will be enabled to develop their water-powers for the benefit of their peoples. The work before us gives particulars of all kinds relating to electrical training, regulations, installations, &c., in Lima and in Peru generally, in great detail.

"Mechanical World" Pocket Diary and Year Book for 1909. Manchester: Emmott & Co. Price 6d. net.—This pocket hand-book appears now for the 22nd year—a good record. Its contents, naturally, are now well enough known to need little comment; but in some directions practice is changing fundamentally, and it has been necessary to rewrite the section on steam turbines. That on friction clutches has also been rewritten, a new section on chain driving has been added, as well as a note on beams, and other improvements have been made. Brevity is the key-note of this work, and in spite of all temptations, to which some similar publications have succumbed, the contents have been restricted to some 300 pages.

Molesworth's Pocket-Book of Engineering Formulæ. By Sir G. L. Molesworth, K.C.I.E., and H. B. Molesworth, M.Inst.C.E.; with an electrical supplement by W. H. Molesworth, M.I.E.E., M.I.Mech.E. London: E. & F. N. Spon. Price 5s. net.—This, the *doyen* of pocket-books, yet ever youthful by virtue of continual revision, is now in its 26th edition and its 47th year. As usual, the matter has been thoroughly overhauled, revised, excised, condensed and expanded. The scope of the book is so extraordinarily wide that we shall refrain from discussing the contents in detail; only with the electrical supplement can we deal at all fully. It consists of some 100 pages, and as might be expected, is generally accurate. On page 743, however, we notice (line 2) "1 amp. per sec." where 1 ampere-second is meant, and (line 4) "condensence" for condensance. The conclusions of the Zurich congress regarding candle-power do not appear to have gained general acceptance yet. In the table on page 744, "ft.-lbs. hours" is a curious expression. A serious error occurs on page 746; regarding the $c^2 n$ loss in heating conductors, it is stated that in the case of A.C. circuits "the impedance must be substituted for n (ohmic)"; but, of course, $c^2 R$ represents the energy lost in watts due to heating conductors in all cases. Some more modern values for permeability of iron might be inserted on page 748; and it is not explained that the hysteresis data given on page 753 do not apply to rotational hysteresis, *e.g.*, in dynamo armatures. We do not wish it to be thought, however, that errors abound in the supplement; there are numerous useful tables, diagrams of connections, formulæ, &c., and apparently the maximum possible amount of information is squeezed into the comparatively small space available. The incandescent lamp section will need a good deal of revision when the next edition is prepared.

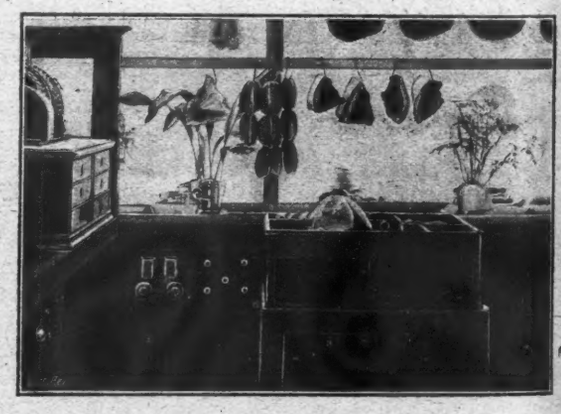
We have received a copy of the December number, No. 9, of a twopenny monthly magazine, entitled the *Investors' Summary.* This issue, among other things, gives a copper fluctuation chart and some notes entitled "Will trade improve?" The conclusion of which is that there are "not wanting substantial signs of encouragement for the new year."

ELECTRICITY IN RELATION TO SAUSAGES.

In the present day of standardisation of electrical appliances there is some danger of the design of these goods assuming a somewhat monotonous character. It is therefore refreshing to come across an example from time to time of the application of this agent to another want of man in a way which betokens experimentation and research. In the following description of the use of electric current in a hot-pie shop, we must not only admire the enterprise which led to the adoption of an improvement upon the ordinary methods of securing a hot supper, but we have to commend the ingenuity with which the details of the problem were thought out and solved.

The Blaydon and District Industrial and Provident Society, Ltd., exerts an ameliorating influence upon the lives of the industrial classes living in this district adjacent to Newcastle-on-Tyne. Among other activities it runs a shop wherein slices from a pork joint, sausages, and pease pudding can be obtained in a heated condition with an appropriate amount of gravy, for the most moderate price consistent with good quality. A short time ago the question of equipping this shop electrically came under consideration, and the chief difficulty arose in connection with the hot-plate or stove which, installed in the window, would produce a comfortable and appetising show of sizzling-sausages and steaming pork.

No standard apparatus of this description being apparently included in electrical contractors' catalogues, a special structure was made which, when put into operation, presented the appearance shown in our illustration. It measures some 30 in. long, 20 in. wide, and 10 in. deep, and is made of copper. On the top is a collection of dishes or trays, one being reserved for a pork joint which is periodically cut in order to furnish the hot pork sandwiches much beloved by the residents, a second for sausages, a third for pease



Electrical Hot-Pie Installation.

pudding, and a fourth for gravy. The last-mentioned dish is 4 in. deep; the others are 2 in. deep. Beneath this set of dishes is a warming chamber for hot pies, which is warmed by the waste heat from the tray heaters to such an extent that the pies are not only thoroughly warmed through, but nearly cooked. This chamber has, so the proprietors say, an additional value, in that it acts on the regenerative principle. When the heat is too much for the gravy only, the pies get it; when the heaters are switched off for economy's sake, the pie chamber imparts its heat to the pork.

The electrical heating of the oven is secured by means of five circular cartridge heaters, 6 in. in diameter, fixed flat beneath the trays. These are easily unscrewed, and are interchangeable. One extra can be kept as spare. The capacity of each heater is 200 watts, and a switch is placed in series with each. To control the whole of the installation a double-pole main switch and fuses are placed in the oven circuit. Although the total energy-consuming capacity of the circuits is one unit per hour, tests taken over ten weeks have shown that the cost of energy is only one shilling to eightenpence per week, owing to the facilities for regulating

provided by the secondary switches. The heaters are capable of raising water ½ in. deep in the trays to boiling-point in five minutes, and are distributed as follows:—One element is reserved for heating gravy only, raising it well towards boiling-point. A second element and a portion of a third are devoted to the sausages, which they can, if necessary, cook. A fourth and a part of a fifth operate on the pork joint. The functions of the third element are divided between the sausages and the pease-pudding, it being discovered, as a matter of experiment, that the latter substance possesses heat-retaining properties in a very marked degree; while a moiety of the fifth is also devoted to the pease-pudding. The *modus operandi* is to cook the various materials in an oven, and put them hot on the electrical hot plate for gradual consumption, with plenty of gravy to keep the elements from melting.

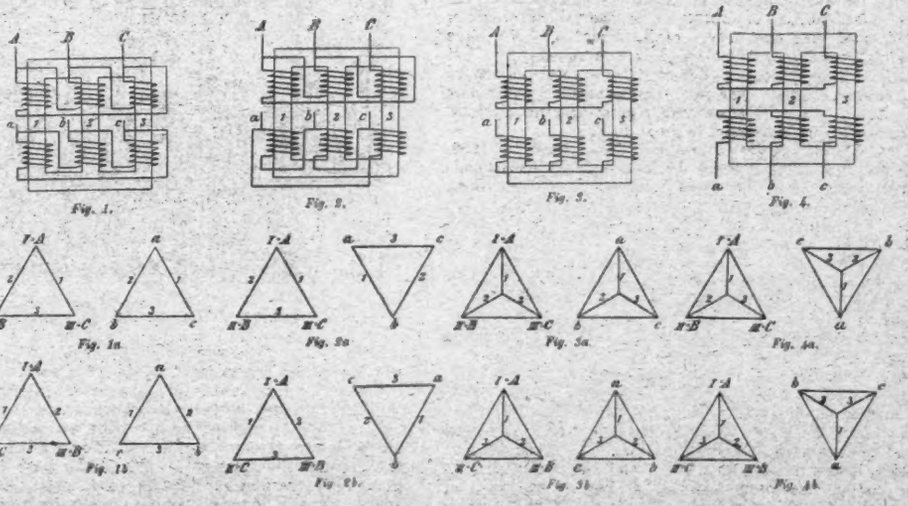
In addition to this specialised installation, a 1½-H.P. three-phase 440-volt motor is installed to drive the sausage machine of the establishment, and six pairs of 125-volt 32-candle power Osram lamps are fed from one phase and the neutral wire to light the window, shops, tripe-cleaning department and slaughter house. The electrical hot plate is tapped off another phase and the neutral wire. The motor is mounted on the wall on a special bracket in order to save space, which is important in a shop of this type.

The above description, although apparently farcical in some of its details, has the advantage of showing that the business of the electrical engineer does not end with the prescribing of kilowatts. He has to study actual conditions of consumption and to acquire a good deal of knowledge that is not taught in the technical colleges. From this point of view, the above notes may prove a useful addition to the literature of that much-discussed and little-understood subject, electrical business-getting.

THE PARALLEL CONNECTION OF THREE-PHASE TRANSFORMERS.

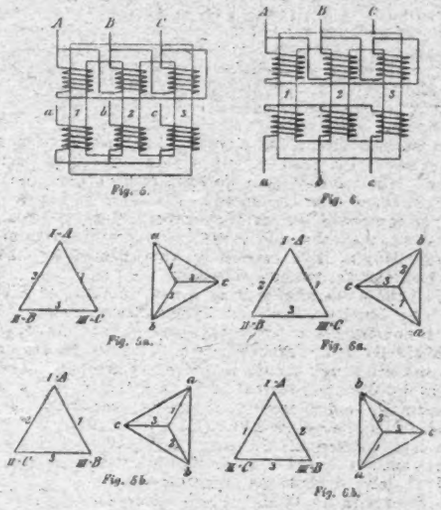
An abstract of an article on this subject by Dr. Stern was published in the Electrical Review for November 15th, 1907, in which the conception of the "network angle" was introduced as an aid to the correct interconnection of transformers. Mr. K. Faye-Hansen, in an article in the *E.T.Z.* for November 5th, 1908, points out that by means of a modification of a simple convention already employed in marking the name-plates of transformers, the same result can be attained.

In all the following diagrams the voltages between the primary supply lines I-II, II-III and III-I are assumed to bear the same constant phase relation to one another. The voltages induced in both the primary and secondary windings depend then, first, on the way in which the primary terminals A, B and C are connected to the lines I, II and III, and secondly, on the way in which the various limbs are connected together. The secondary terminals are marked



a, *b* and *c*, and the secondary line voltages are *a*-*b*, *b*-*c* and *c*-*a*.

In fig. 1 a transformer is shown having mesh-coupled primary and secondary, the interconnection of the three limbs being similarly carried out on both sides. Fig. 1*a* shows the corresponding primary and secondary voltage vector diagrams, assuming that lead I is connected to A, II to B and III to C. It will be seen that the voltage A-B, which is induced in the primary winding of limb 2, is alike in amount and direction with the primary supply voltage I-II. In the secondary winding of that same limb, a voltage *a*-*b* is induced, which must be in phase with the primary voltage A-B, and must be drawn so in the diagram. In the same way the voltage direction in the other limbs can be



readily determined. If two of the primary supply leads are now interchanged, I being connected to A, II to C and III to B, the vector diagram becomes as shown in fig. 1*b*.

Fig. 2 shows the case of a transformer with P and S still in mesh, but with the interconnection of the three limbs different on the P and S sides. Figs. 2*a* and 2*b* give the vector diagrams for this arrangement with two different connections of the primary leads to the primary windings.

Figs. 3, 3*a* and 3*b* show the connections, &c., for a transformer with star-connected primary and secondary, with the limbs connected alike in P and S, whilst figs. 4, 4*a* and 4*b* show the same, with limbs dissimilarly connected on the P and S sides. In all these cases—*i.e.*, with P and S either both mesh or both star connected—it will be seen that merely interchanging two of the primary leads causes no change in the position of the secondary vector triangle. When, however, the primary is mesh-connected, and the secondary star-connected, or *vice versâ*, the result is different Thus fig. 5 shows a transformer with the P mesh-connected and the S star-connected. With lead I connected to A, lead II to B, and lead III to C, the secondary vector diagram

is as shown in fig. 5*a*, whilst, with lead I connected to A, II to C and III to B, the position of the vector triangle changes as shown in fig. 5*b*.

Figs. 6, 6*a* and 6*b* show the corresponding case with the interconnection between the secondary limbs changed. The only possible remaining combinations are the two obtained with a star-connected P and a mesh-connected secondary, and these can be readily deduced from figs. 5 and 6.

It is, therefore, clear that, so long as the P and S are either both star or both mesh connected, Dr. Stern's "network angle" is definite, but when the two windings do not have the same coupling, it is indefinite, as its value changes when two of the primary leads are interchanged. The diagrams show that transformers connected like figs. 1 and 2 can work in parallel if the proper secondary terminals are connected together, also transformers like figs. 3 and 4, but in the case of figs. 5 and 6 (as well as in the corresponding cases with star primary and mesh secondary), parallel operation is only possible with particular primary lead connections. There are, in fact, three groups of arrangement such that transformers belonging to the same group can be connected in parallel, whilst if of different groups, no parallel connection is possible without a rearrangement of the internal connections of the transformer.

The three groups are (1) transformers with the same coupling of P and S and with the same arrangement of the limbs of the P and the S (figs. 1 and 3); (2) transformers with the same coupling of P and S, but with different arrangements of the limbs on P and S (figs. 2 and 4); (3) transformers with different coupling of P and S (figs. 5 and 6).

In order to be able to distinguish from the name plate to which group a particular transformer belongs, Mr. Faye-Hansen suggests that the symbols Y and Δ should be stamped against the voltage, as is, in fact, already done by many makers, and that these symbols should be reversed in order to indicate difference in the interconnections of the limbs thus:—

Δ Δ (fig. 1) Y Y (fig. 3)	group (1)
Δ ∇ (fig. 2) Y Y (fig. 4)	group (2)
Δ Y (figs. 5 and 6) Y Δ	group (3)

Usually, in order to avoid confusion, a given maker will arrange all his transformers in one particular way so that all belong to group (1), to group (2), or to group (3). The writer suggests that group (1) is the best to retain for this purpose, because (1) auto-transformers using this connection can be connected in parallel and (2) in case of repeated transformation the secondaries can be kept in parallel throughout.

A FRAGMENT FROM A MAINS DIARY.

(Precipitated from the Ether).

The horror has now haunted me for close on six years. In March of the year 1902 the study of Eastern writings, and the accounts of the research work undertaken by many prominent men with the idea of examining the structure of the atom, which we used to be taught was indivisible, the surrounding and the interpenetrating presence of ether, electrical phenomena, and the gradual decrease in density of the envelopment of all objects, the rarefaction of senses somewhat similarly to the envelopes, had all riveted my attention and made me keen to experiment in these directions. It was the last branch, namely, the rarefaction of senses, that proved the most tempting bait, and it was this study that led me through strange experiences.

The Eastern races regard as accepted facts things that we Western people are dubious and sceptical about, and so the numerous warnings concerning the course of study I had mapped out merely excited supercilious smiles.

I read greedily of the possibilities of etheric and mental vision, and determined to cultivate such senses at the earliest possible time. (How this may be done is plainly set out for anyone to read, but, lest others be impetuous enough to follow my example, and sceptical enough also to skip the warnings, the names of such books will not be here quoted.) After a time instinctively came the knowledge that provided I could mentally picture an object at a distance, I could actually see the object, and also could see it with that sight of fourth dimensional power which reveals exterior and interior.

An experiment, of course, rapidly followed the knowledge of power. The mains stores—of course a familiar place to me—was no sooner imagined than seen: the jointer making up lead sleeves, a labourer cleaning tools, and many familiar objects—strangely mixed, however, for one seemed to see progressively the outer wall, the jointer, cable drums, the cable, the lead with the paper and copper, each showing through the other, and everything standing strangely in the wrong places.

From my studies, I recognised that this distortion was due to my being able to use only a class of sight which shows the picture as it would appear in a mirror, and enables one to see the interior by first penetrating the exterior, instead of the clear undistorted simultaneous picture given by the mental vision.

Experiment followed experiment, ranging from the works to the most remote sub-station, each picture seeming clear or dense in accordance with the amount of concentration devoted to it, and each becoming easier to read as I became accustomed to the mirror effect. An attempt to use the vision for my own personal benefit—to save time going to look up a train—brought only partial success, and in a vision of a chief I had worked under, and whose judgment I much respected, he seemed to picture rather than to say to me "Take care unless you know how to protect yourself by means of . . . . "—the vision vanished before the warning was complete.

Days passed, and the new power did not desert me. Occasionally when I was engrossed in a piece of work, rather startling visions suddenly passed through my brain; an ultra-ultra-violet ray message fluttered across like a cloud crossing the face of the sun on a windy day. In fact, these electrical disturbances became a nuisance—too many clouds make the horizon dark—and the wireless vibrations were becoming more and more intense each day. As well as clouds of wireless messages, other visions became more and more frequent; one of a manhole cover rising in the air used to make my nerves jump, until one day the vision showed the exact neighbourhood, and the police telephoned an explosion within the next half hour!

When next we had a fault on, after the cable concerned had been isolated, I concentrated my attention on the cable, the service boxes, &c., as far as possible. By luck, within the last six months I had seen an old service cable when we had the ground opened near by, and so could get a moderately clear picture of its service joint. Directly this was thought of, the vision followed and—it was the right place! A triple-concentric cable, lead gone for an inch, neutral through, intermediate and inner dead short, the molecules of copper still in a state of rapid vibration. The fault was there all right when the ground was opened.

In a similar manner, in a thunderstorm the position of a faulty insulator a mile away on the overhead was successfully seen.

But the uncalled-for visions, now changing to objects that made one gasp for breath, so sudden and startling were they, became more recurrent. At night one would seem to be dragged from one's physical body and be rushed through all intervening substances direct to a distant spot, to be the onlooker at some frightful accident—to see everything leading up to it and be powerless to prevent the accident or to help the sufferers. My self-elected guides for these midnight rambles always seemed to choose the most gruesome pictures for my inspection—a colliery, the gas (visible on our plane) collecting, the piece of cable with the insulation damaged, a short circuit—and next morning's papers would contain headlines announcing the disaster to the world; not only could one see, but also foresee, the whole accident, and yet be absolutely powerless to warn or to prevent.

From these constant trials my nerves suffered considerably, and the means of protection from uncalled-for intrusions were not yet made efficient. A protection could be obtained to some extent from interruption to concentration,

but the night excursions still continued, with a result that I could never feel rested in the mornings or fit for work.

I have clearly seen nearly every inch of cable in the town, for, as one practises, one learns how to arrive at a vision which one is not previously in touch with.

There are, however, two of the most important cables which defy all endeavours. Ordinary tests show good insulation, and yet there is a recurring picture of a large explosion, causing loss of life. The locality I cannot see, nor the exact cause, but employing the higher senses to look along the copper, I seem to see, from the inside, one spot where the insulation has become extremely thin, and it is at this spot that the big fault will occur.

Now, I cannot fix the locality, nor can I sufficiently convince others in this sceptical age of the possibilities of higher vision without proofs, and whenever I have tried to localise a fault, telling anyone that I proposed to try higher vision for the purpose, the experiment has proved useless, and has led absolutely astray, leaving one with the "cut and try method" to fall back on. Therefore I cannot, against the judgment of the "megger," convince anyone that one of the two cables is absolutely dangerous.

Why cannot I pick out the locality? I will concentrate as I write these experiences, and set out the solution of the protection solution that is just dawning on me.

Anyone following my example in the quest for wisdom must, for his own peace of mind, first be sure that he is—the vision again comes, the explosion occurs—one, two—no, I cannot look at the ghastly carnage—it must be a market day. It is now becoming clearer; something happens, another body is added—the clothes, yes! and the watch chain—they are mine!

To leave matters straight I'll ring up the switchboard: "Hello, keep an eye on No. 8 and 10 feeders, switch off if any trouble shows, and send the gang to Enderby Street pit. I'm going there now."

Now to see if the last location is true, for this is market day . . . .

THE LABOUR CO-PARTNERSHIP ASSOCIATION.

It will be news to those who have looked upon the profit-sharing experiment recently inaugurated at the Furness shipyards as a novel departure in industrial methods, to learn that there has been in existence for 23 years an association whose objects are to bring about an organisation of industry based upon the principle of Labour Co-partnership. The twenty-third annual meeting of this Association was held in the Large Hall of the Church House, Westminster, on the 1st inst., when a large gathering assembled to hear the presidential address of the Right Hon. A. J. Balfour, whose year of office has just expired.

Surrounded by labour members and others directly interested in the labour side of the industry, Mr. Balfour appeared to be rather nervous, and his words did not flow very freely. He hesitated and paused frequently, as though at a loss to find words to express his thoughts, although what he said was quite in harmony with the fundamental principles of the Association.

He pointed out that Industrial Co-partnership was not an untried experiment. It had been tried, and very successfully carried out, in many trades, and whilst it might not be possible in its complete and ideal form in all branches of industry, the Association welcomed every attempt to put the principles of co-operation into practice, however slight the attempt might be.

There are, continued the speaker, critics who say that an industrial concern cannot be carried on on democratic lines. That is to say, that a business requiring initiative and commercial acumen cannot be run by a committee. Whilst this criticism was sound, a committee working on the lines of, say, the Cabinet in the British Parliamentary system, is quite a good method. Here we have individual control of departments. Each head of a department has associates and a chief whom he can consult either individually or collectively, and the chief is responsible for the general policy of the Cabinet. A committee system in which there is collective control of everything, is quite unworkable, and the abler the committee the more inefficient it is, a paradox which caused some amusement.

One department in which the co-partnership principle is applicable, said Mr. Balfour, is in building estates. He was a firm believer in individual ownership of houses and land, but the small owner was in a very helpless position, and could do nothing to prevent the depreciation of his property by the operations of other neighbouring owners and of the speculate builder. Co-partnership in estate development gave the advantages of individual ownership of houses, together with co-operative control of large estates.

The speaker wished to remove the misconception that the underlying idea of co-partnership was to stimulate the men to greater effort, and so increase their earning capacity and provide more profits for the employer. It went deeper than that. A man's work ought to be a pleasure to him, or at least interesting. The introduction of specialised machinery had tended to make work more monotonous; but uninteresting details made up an interesting whole, and by a co-partnership system, men would realise that, although their individual part in the work might be small and uninteresting, yet they were essential and important parts of a vast and interesting undertaking. Another result of co-partnership would be to make men realise and appreciate the difficulties of the employers, in organisation, management, and in finding a market for their products, and in this way their views would be broadened.

Sir Christopher Furness, M.P., in moving a vote of thanks to Mr. Balfour for his address, made a somewhat lengthy apologia for the strike clause which he had insisted upon in his co-partnership agreement. It was evident that the meeting was not entirely in sympathy with him, and became restless long before he had finished reading his speech. The dominant note of egotism is, perhaps, pardonable in a man who can refer to his 27,500 employés and his wages bill of £60,000 a week, but there was clearly an underlying feeling among the representatives of labour that here was a masterful man who would always be the employer at heart, and that the co-partnery scheme was for him, at any rate, a means to increased profits. Sir Christopher said that he had been induced to put forward the scheme as a result of a close investigation into the operations of his various companies. He found that owing to sectional strikes among the 20 or 30 trade union societies represented by his army of workmen, there was a serious wastage which amounted to 21¼ per cent. of the wages bill, or 9¼ per cent. of the aggregate capital. When we remember that the Furness companies pay £60,000 a week in wages, it is seen that this wastage amounts to about £630,000 per annum. Under these circumstances, he would have nothing to do with any co-partnership scheme which did not abolish "the strike habit" which had resulted in such enormous waste; and he, therefore, insisted on the strike clause being embodied in the agreement.

Prof. Pigou, in seconding the resolution, dealt with co-partnership from the academic side of the question, and his remarks were much appreciated. He said that the principle of co-partnership had definite and direct economical advantages over other forms of industrial organisation, in that it gave the workmen greater interest in their work and broadened their views and gave them opportunities of appreciating both sides of the industrial problem—namely, the employers' as well as the workers' side. On the other hand, the principal advantage claimed for the premium or piecework system was that it tended only to stimulate the men from the point of view of self-interest. He pointed out further that the direct efficiency of production was not synonymous with efficiency, as a whole, because after all the end was not the actual material product turned out, but men; and the sum total of efficiency had to be reckoned in terms of fellowship, comradeship and loyalty to each other, rather than in terms of dividends.

The resolution was supported by Mr. Amos Mann who spoke from the point of view of the workman who had actually had experience in co-partnership production. Speaking for the men of Kettering and the Midlands generally, he said they would have had no hesitation in accepting Sir Christopher's first proposition—namely, to take over the whole works as a going concern. Experience had shown that

workmen, when given opportunities, had shown administrative and organising ability, and he gave many interesting figures with a view to showing that with a very few exceptions the whole of the co-partnership schemes now carried on by the men are profitable. In the industry in which he was particularly interested—namely, the brot-making trade, they started in Leicester 16 years ago with £120 capital and at the present time they had £8,000 accumulated capital; they complied with all trade union conditions, and, in fact, went beyond this in working 49 hours a week, and had now an annual turnover of £35,000. The amount of capital now invested in co-partnership schemes amounts to £1,900,000. As a result of such schemes they could point to industrial peace, such a thing as a strike never having been known, notwithstanding the fact that there was no strike clause in any of their agreements. The idea of a partner striking against a co-partner was almost unthinkable.

LEGAL.

Macaulay v. G.N., Piccadilly and Brompton Railway.

The finding of the jury in this case was reported in our last issue. On Thursday, December 3rd, after legal arguments, his Lordship entered judgment for the defendant company with costs.

His Lordship said the jury had found that Tomlinson was in the employment of the company at the time, and that was against the weight of evidence.

Leave to appeal was given.

The Rights of Tram Passengers.

At Brentford County Court on the 1st inst., before Judge Howland Roberts, Mr. Charles James Carlyle Forrester, of Hillingdon, Middlesex, a great grandson of Thomas Carlyle, sued the London United Tramways Co. for damages and personal injuries.

Plaintiff took a ticket from Hillingdon to Ealing, and at Hanwell depôt was asked to leave the car, which was going no further. He was then a mile short of his destination, and when a car for Ealing came along, he entered it. The conductor refused to allow him the use of the ticket issued to him on the previous car, and as he declined to pay another penny, the conductor took him by the shoulders and ejected him with such force that he was thrown to the ground, was injured severely, and his clothes were spoiled. On his behalf it was urged that the company's bye-laws gave the conductor no right to eject a passenger who refused to pay a legally demanded fare, but, under such circumstances, the company must summon him before the justices.

The jury accepted this view, held that there was an unwarranted interference with plaintiff's rights, and found for him with £100 damages.

Westminster Electric Supply Corporation, Ltd., v. L.C.C.

The adjourned proceedings in the arbitration action between the Westminster Electric Supply Corporation, Ltd., and the L.C.C. were resumed in the Surveyors' Institute on Thursday, December 3rd, before Mr. Symons, K.C., umpire, and Messrs. Young and Falconer, arbitrators.

Mr. Balfour Browne, who appeared for the corporation, read a statement as to an arrangement come to regarding the question of mains. The tribunal, he said, would remember that there was a claim by the corporation for the arrangement of mains in connection with the new station. Mr. Snell, on behalf of the L.C.C., and Sir Alex. Kennedy for the corporation, went into the matter very carefully, and Mr. Snell had agreed to the principle laid down by Sir Alexander Kennedy, at the last sitting of the Court, that the loss in the feeders after the change should not be greater than at the present time. Mr. Snell submitted a modified scheme regarding quantities, and showing a very large saving in the cost of pipes, cables, roadwork, &c. On examination, Sir Alex. Kennedy found Mr. Snell's suggestions to be correct, and had expressed his willingness to adopt them. Sir Alex. Kennedy had obtained a new tender from the Messrs. Callender and Mr. Snell from the British Insulated & Helsby Cables Co. They found, in comparison, that the tenders were pretty equal, Callender's being a little behind. Sir Alex. Kennedy and Mr. Snell, however, agreed to leave the amount to be paid to be founded on Callender's tender, which amounted to £34,739. That tender was based on copper at £66 and lead at £18 15s. per ton. The market price of lead was £13 5s. per ton, while copper was sold at £66, so that the actual amount of Callender's tender, if accepted to-day, would be £.96 less, or £34,143. To this is was agreed that there should be added 5 per cent. for engineering charges—£1,707, and 10 per cent. on the roadwork, £829—making a total of £36,679. Sir Alex. Kennedy claimed 10 per cent. on the cost of mains and pipes (£25,853)—£2,585, and £250 for high-tension alterations. Mr. Snell agreed upon only 2½ per cent. on the £25,853, with £350 on the double set of mains, and £250 for high-tension alterations, representing £1,236—a difference between them of £1,249. It is understood that the tribunal shall be asked to fix a reasonable period for the final settlement of the specifications, and that the exact amount to be paid shall then be adjusted by the Court if the price of copper and lead have undergone any alterations at the time of the acceptance of the contract.

Mr. Lockey, director of the firm of Gardner, Locket & Hinton, and chairman of the Society of Coal Merchants, said, in answer to Mr. Shaw, counsel for the Westminster corporation, that he had considered the question of carting coal to the new station in Horseferry Road, as compared with barges to the existing station, and, in his opinion, the difference would be 3s. 3d. per ton dearer.

Mr. J. Carrington, of Carrington, Sells, Dale & Co., and hon. sec. of the Coal Merchants' Society, said that the average rate of cartage would be nearly 3s. 4½d. per ton.

Mr. T. H. Hordern, of the Westminster corporation, said that the demand for power for heating and supply was increasing very rapidly, and that the heating had doubled during the last two years. During 10 years—from 1895 to 1905—the demand had increased greatly, the connections rising from 469 kw. to 700 kw. in 1907. This year it will be much about the same, or perhaps a little more. He stated that they had in hand at the present time a large number of additional applications which would amount to about 1,000 kw., while the number of connections this month would be between 150 and 200. In his estimate of future business he stated that in 1910 the company expected to produce 7,000,000 units, and that they expected they would go on increasing year by year by 380,000, until 1931 was reached, when they expected their output would be 14,980,000 units. Up to 1931 he considered that the estimated increase would be maintained. Cross-examined by Sir Edward Clarke, he said that the steam plant at Millbank Street gave 2,536 kw., and the motor generating plant 2 890 kw., a total of 5,426 kw. Witness admitted that the units generated at Millbank Street by the steam plant had been steadily reduced from 4,050,000 in 1903, to 2,265,000 in 1907. That was accounted for by the increase in the motor-generator output. They would have had to increase their plant practically every year in order to cope with the increased demands. Re-examined by the Hon. A. Lyttleton, Witness remarked that but for the interruption on the part of the L.C.C., they would have continued their steam plant, and as they had room capacity in their buildings, further extensions of the steam plant rather than of the motor-generator plant would have been made.

This closed the evidence for the Westminster Electric Supply Corporation, Ltd., and Sir Edward Clarke, in opening for the L.C.C., said the way in which he proposed to deal with his case, was one that would simplify matters in regard to the buildings. The question between them was that of proportion. Mr. Peach in the plans which he put before the Court of the elevations, and also of the new site in comparison with the old, stated that what the L.C.C. ought to pay was seven-tenths of the expenditure. That would depend upon a fair comparison being made between the old building that now exists, and the new building for which the L.C.C. were liable. What he proposed to do was to put evidence before them, also plans showing the cubical contents of the two buildings, the area of the buildings, and how plant of an equal capacity to that which now exists at Millbank could be put into a building very much smaller than that for which they were being charged. The question whether in principle that was the right way to deal with it, he would not touch upon, but would leave for the tribunal to settle. The result of the calculations which would be put before them would show that the L.C.C. were only liable for less than half of the cost of this building construction. He was glad to say with regard to the expenditure upon the mains that an agreement had been arrived at, and the matter between them was only some hundreds of pounds. Regarding the question of plant, he would lay some evidence before them, and also as to the necessary accommodation for plant of a character equal in capacity to that at Millbank. Upon that subject he also hoped to show that less than one-half of the charge that was being made was the charge for which the L.C.C. would be liable. In view of the evidence which had been given regarding the question of coal, and the estimate of future business, he would probably also call some evidence. To put an increase in the way in which it had been put, and to charge for 21 years of that increase at the present moment was, he submitted, an extravagant and unjust way of dealing with it.

Mr. Stewart, architect, examined by Sir Edward Clarke, submitted plans of the Millbank and Horseferry premises, and compared their cubical areas. He stated that he measured the Millbank premises as they existed. Cross-examined by Mr. Balfour Browne, Witness admitted that the corporation were entitled to a proper foundation, and that in his measurements he did not take into consideration the cubical space of the temporary premises at Millbank, which they (the corporation) sought to be of a permanent structure at Horseferry Road.

Mr. Slater, examined by Mr. Hutchison, counsel for the L.C.C., said that he had a special experience in the designing of generating stations. He had examined the estimates submitted by Mr. Peach, and in some respects he disagreed with Mr Peach's figures. He said he did not know of any agreement between the L.C.C. and the corporation, that the front of the new building should be built of stone, and he could not understand why the L.C.C. should be asked to pay £800 for carving and decorating work. He contended that the corporation accepted the site, and therefore they had to take the risk regarding the suitability for foundations.

On Friday, Mr. Balfour Browne intimated that Messrs. Callender would only keep their tender open to the 10th inst.

because of the possibilities of fluctuations, and his learned friend for the L.C.C. having stated that the corporation "may accept the offer," the tender would, therefore, be accepted, and the only question now was on the £1,300, whether it was to be 10 per cent. or 2½ per cent. Mr. Balfour Browne told the tribunal that the corporation had agreed that the price of cartage of coal should be put down at 2s. 4d. per ton instead of 3s. 3d., as stated on the previous day, therefore leaving for the tribunal the question of capitalisation. Sir Edward Clarke stated with regard to the subway that the County Council were to do the work, but that the corporation should pay the L.C.C. £3,400 for so doing. In any case, the corporation were to pay the L.C.C. £300, the difference between the 16 in. and 20 in. pipes, the difference of £3,100 to be settled by the Court.

Mr. J. F. C. Snell, examined by Mr. Morten, said that half of the boiler room floor area at Horseferry Road was quite competent to hold the equivalent amount of plant which the corporation had at their Millbank station. He was quite satisfied that the 2,526 kw. of plant which represented the kw. at Millbank station could be easily accommodated in half of the engine room and boiler house as now provided. The area was sufficient to hold five times the present amount of plant installed at Millbank. He stated that less than one-half of the cubical contents of the new building was sufficient to meet the provisions of the corporation. He would not allow £860 for stone facings. His estimate of the building for which the L.C.C. should pay was £44,799 as against Mr. Peach's estimate of £73,809. Mr. Snell then dealt with the plant which he proposed should be introduced at Horseferry for the purposes of reinstatement. He provided for the corporation a pumping capacity of 12,000 gallons per hour; and in the engine room generators of 2,336 kw. and motor-generators of 2,890 kw. Mr. Balfour Browne stated that the plant for the Horseferry station had been ordered and that the tenders had never been questioned. The corporation could not now agree to the proposals of Mr. Snell. Sir Edward Clarke stated that plant which the L.C.C. were to pay for was to be of equal capacity, and Mr. Snell was simply to indicate plant which the L.C.C. were prepared to pay for as reinstatement. The following is a summary of Mr. Snell's plant:—

Boiler house section	£13,836	0	0
Pipework, &c.	5,484	13	6
Engine room	20,150	0	0
Motor-generator and battery room section	11,522	0	0
Switchboards	4,800	0	0
Tools, contingencies, &c., 5 per cent.	2,789	0	0
Engineering, 5 per cent.	2,789	0	0
	£61,370	13	6

Sir Alex. Kennedy's estimate was as follows:—

Steam plant	£61,443
Motor-generators	23,130
	£84,573

Mr. Snell contended that Mr. Hordern's coal estimate was excessive, that his allocation of the units of the steam and motor-generator plant was excessive and unwarrantable, and he (Mr. Snell) submitted that his figures were fair and reasonable. He then dealt with the difference in the percentage—10 per cent. as designed by Sir Alex. Kennedy and 2½ per cent. as offered by the L.C.C. Regarding this he said that there would be no change in the quantities of cables, pipes, &c., and he therefore submitted that 2½ per cent. was an extremely reasonable figure to allow. In cross-examination conducted by Mr. Balfour Browne, he stated that he based his annual estimate in kilowatts upon existing statistics. In 1910 he estimated it at 5,849,900 units, and his figure for 1931 at 11,272,800, or in 21 years an annual increase of 256,000 units. He admitted that the increase of the corporation for the past ten years had been 386,500, but witness said that he based his estimate on the past five years. Mr. Snell stated that he was putting in greater engine power than the corporation had at present, and he admitted that if the corporation had put in the same class of engine in Horseferry Road as they had at Millbank his estimate of £61,371 would be considerably increased. He said that the difference between the amount of the old battery and the new one was not worth quarrelling about, but what he maintained was that he could have replaced the battery as existing at Millbank at a far less cost than that of the one the corporation were putting in at Horseferry Road.

At Saturday's sitting, Mr. Snell was further cross-examined by Mr. Balfour Browne, and stated that in his plans he provided for an independent supply of electricity to the House of Commons.

Mr. C. H. Gadsby, consulting engineer, stated, in answer to Sir Edward Clarke, that the Millbank station was a peculiar one in many respects, and there were certain disadvantages as regards shape and arrangements. He submitted plans showing that the boiler house was capable of holding 8,000 kw., and the engine room 8,600 kw., while in the motor-generating room 14,500 kw. capacity could be installed. He pointed out that half the space provided by the corporation was capable of holding the boiler and engine-room machinery as now existing in the Millbank station. He estimated that the cost of the building which the L.C.C. should be called upon to pay, should be £48,547, as against Mr. Peach's £73,809. His estimate was slightly higher than that of Mr. Snell's. The amount of steam plant which he proposed to allow for reinstatement purposes was £42,342, and motor-generating plant £13,234. This gave a total of £55,576, as against Sir Alex. Kennedy's estimate of £84,536. Witness admitted in cross-examination that in an independent estimate which he worked out himself, he was prepared to allow over £62,000. He admitted that it was not exactly possible for the corporation to have put up a building of half the capacity at half the cost.

The proceedings were again adjourned.

Cole v. Maxwell, Butcher & Co.

In the City of London Court on Monday, before Judge Lumley Smith, K.C., a claim was made by Mr. John Cole, manufacturer of electric motors, Chapel Road, West Norwood, against Messrs. Maxwell, Butcher & Co., electrical engineers, 77A, Queen Victoria Street, E.C., to recover the sum of £25 16s. 10d. for 12 electric motors supplied in July. Mr. F. Hinde appeared for the plaintiff, and Mr. Simner for the defendants. Defendants alleged that the motors were faulty, and raised a counterclaim for £33 damages.

Plaintiff's case was that in March the defendants asked if he could supply two sample electric motors, which he did. Plaintiff inquired what purpose the motors were wanted for, but he was not informed. Subsequently defendants ordered 12 motors as samples, and they were sent on July 18th. Defendants were practical electrical engineers, and thoroughly understood them. Mr. Butcher complained that four insulators were missing from the feet, and they were sent on. Defendants' customers then complained that the machines were unsatisfactory, and he found that the batteries were unsatisfactory, and wanted adjusting. Subsequently it was admitted that they were all right. They were sent by the defendants to Birmingham for the purpose of running phonographs. There was no doubt that the motors were not the most suitable for that purpose. Defendants now refused to pay for the motors, and counterclaimed for damages. Mr. Cole added that at first he supplied motors for 6 volts, and they were altered to 4 volts. The batteries used, which he did not supply, were too small. He found that the pin that held the brush-gear had been riveted through by the defendants. Apparently someone found that it was loose, and he had riveted it in the wrong place, and screwed up anything he found loose. If put on to suitable work, the motors should last a considerable time.

Defendant said that the machines were defective. He had had 19 years of electrical engineering. His customer refused to have them. The condition of the commutators prevented the motors from working. He did not examine them thoroughly before sending them on to his customer. There was no doubt the batteries were unsatisfactory.

Two expert witnesses were called in support of the defendants' case.

Judge Lumley Smith found for the plaintiff on the claim for £23, and on the counterclaim, with costs.

Lloyd's Bank, Ltd., v. The Aluminium Corporation, Ltd.

On Friday last counsel for plaintiffs applied in the Chancery Division for the appointment of a receiver and manager in the defendant company, their action, according to the *Financial Times*, being a mortgagee's action to enforce a security. It was stated that the bank had advanced to the corporation £26,200 on the terms of the deed, and that on November 26th £24,000 was due for principal and £312 for interest. The bank having heard that there was a judgment against the corporation, and that execution was threatened, asked to have a receiver and manager appointed. The main business of the corporation, he added, was the manufacture of aluminium at its works in North Wales, and its assets included freehold and leasehold property, plant, &c. Mr. Hawkins, the secretary, who was a chartered accountant, said that at the present time there was 110 tons of aluminium in stock, and a quantity of material capable of making, when worked up, a profit of £2,500. The company had favourable contracts which could be carried out with the existing stock, and he asked that Mr. Hawkins be appointed receiver and manager for the purpose of working out the material at the works. Mr. Macaskie, for the corporation, said there was no objection, and his Lordship made the order asked.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

ARGENTINE REPUBLIC (*concluded*)—

The duty is 27% on the undermentioned values, except where shown otherwise in brackets:—

	Pesos.
Cylinders for resistances of arc lamps, per kg.	·15
Insulating tape, tarred, per kg.	·80
Ditto, of rubber, per kg.	1·60
Commutators in general, each pin	2
Meters, apparatus and instruments for measuring electric current, including those for lighting, each	12
Indicators for electric bells and telephones, each number	·50
Ebonite and vulcanised fibre in sheets, tubes or bars, per kg.	1·20
Galvanometers, portable, each	8
Arc lamps and their regulators, with their resistances, fittings and globes, up to 60 cm. in height, excluding bulbs and supports, each	12
Ditto, more than 60 cm. in height, each	16
Ditto, more than 1 metre in height, each	20
Incandescent lamps in general, including Nernst lamps, per kg. gross	·80

ARGENTINE REPUBLIC.

	Pesos.
Table lamps, common, with foot of iron, zinc or lead, with or without burner, or other similar piece, except the globe, per doz.	3·80
Lamps of iron or bronze for hanging, per doz.	6
Lamps of bronze or nickel for hanging, with or without support of iron, per kg.	1·20
Ditto, with porcelain or glass, per kg.	·80
Electric pocket lamps of copper, bronze or nickel, per doz.	6
Ditto of paste, papier maché or cardboard, per doz.	2·50
Metals or elements for batteries or accumulators in general, per kg.	·20
Motors and dynamos in general, per kg. (gross) (5 %)	·30
Electric motors for fans, complete or not, each	8
Shades for lamps, of tin-plate, zinc, paper or cardboard, with or without frame, per kg.	·40
Ditto, of silk or mixed silk, with or without ornaments, with frame of wire, including the box, per kg.	5
Ditto, of wool, wool and cotton, or cotton, per kg.	2
Hooks of iron, for insulators, per kg.	·12
Batteries of all kinds, per kg.	·25
Porous jars, charged, for batteries, per kg. (gross)	·12
Ditto, not charged, per kg. (gross)	·20
Carbon holders, of copper, per kg.	1
Resistances for arc lamps, per kg.	·20
Resistances for electric motors, per kg.	·30
Telephones, domestic, without bobbin, finished or not, each	2
Telephones with bobbin, finished or not, each	3
Magnetic telephones, finished or not, each	7
Flexible tubes of asphalte and india-rubber for electrical purposes, per kg.	·35
Insulator tubes, Bergmann system, with accessories such as elbows, sockets, derivation boxes, &c., not coppered, per kg.	·30
Ditto, coppered, per kg.	·40
Insulator tubes of iron, beaten or cast, with or without accessories, varnished or not, per kg.	·12
Insulator tubes of mica, general, per kg.	2
Jars for batteries and accumulators of glass of all forms and dimensions, per kg.	·07
Ditto, of eartherware, varnished or not, per kg.	·10
Ditto, of papier maché and other materials, per kg.	·25

The above articles when imported in sacks, bags, or rollers are dutiable on the gross weight; those imported in any other manner are dutiable on the weight, including paper, wrappings, cardboard or wooden boxes, and reels, unless the method of weighing is definitely stated.

Lamps provided at the foot with an iron plate or rim are considered as bronze, nickel, or nickeled lamps.

The above articles imported nickeled or polished, and not specially provided for, are liable to surcharges of 25 % and 15 % respectively on the rates to which they are classed.

5% on undermentioned values:—	Pesos.
Motors or portable engines, imported separately, each	1,000
Machines in general not specially mentioned in the tariff, up to 500 kg. weight, per kg. (gross)	·30
Ditto, from 500 to 1,000 kg. weight, per kg. (gross)	·20
Ditto, over 1,000 kg. weight, per kg. (gross)	·15
Galvanised iron wire up to No. 14 inclusive, per kg.	·05

27% on undermentioned values:—	
Ditto, from No. 15 to No. 21, per kg.	·10
Ditto, more than No. 21, per kg.	·14
Wire of iron or steel, coated with bronze or copper, per kg.	·08
Copper wire, in general	·45
Ditto, less than 5 mm. diameter, per kg. (5 %)	·45
Ditto, tinned, per kg.	·45
Steam boilers, per kg.	·08
Used rails, per kg.	·02

Duties must be paid at the gold rate of exchange, the gold peso being equivalent to 4s.

No duty is levied on machines, implements and materials necessary for the installation and operation of mining establishments and metal works, which either exist or may be erected in the Republic.

Wedges, rails of iron or steel, iron sleepers and fish-plates for railways or steam, horse, or electric tramways, locomotives and parts, also plant for the installation and traction of electric tramways, namely, carriage motors and gears, cables, trolleys, wire, bobbins, fuse boxes, brakes, rims, lightning guards, springs, insulators, controllers, rosettes, switches, and points, are admitted free of duty.

Whist Drives.—A series of whist drives are being promoted for the benefit of the large staff of employés of the Lancashire United Tramways Co., Ltd., during the coming winter months. Suitable prizes will be given.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

25,134. "Improvements in or relating to automatic switching or controlling apparatus for the distribution of electricity." E. G. Bryant and R. H. Pearson. November 23rd.

25,182. "Improvements in galvanic batteries." A. M. Aubert and J. M. Aubert. November 23rd. (Complete.)

25,208. "Improved process and apparatus for the electrolytic decomposition of alkaline salts." J. Greenwood. November 23rd.

25,264. "Improvements in or relating to electric accumulators." Van Raden & Co., Ltd., and M. Metz. (Date applied for under Rule 13, February 7th, 1908. An invention comprised in application No. 2,727/08, dated February 7th, 1908.) November 24th.

25,267. "Improvements in or connected with apparatus for testing electro-magnet coils." J. F. Simpson. November 24th.

25,279. "Improvements relating to universal joints or couplings for electric light fittings and other purposes." C. J. Thursfield. November 24th.

25,305. "Improvements in electric signalling." R. A. Fessenden. (Date applied for under Sec. 91 of the Act, December 23rd, 1907, being date of application in United States.) November 24th. (Complete.)

25,330. "Improvements in the method of reinforcing concrete for the manufacture of telegraph poles, pipes, piles and the like." E. Le Bas. November 25th.

25,333. "Improved construction of circuit breaker." Verityb, Ltd., and W. G. Pipkin. November 25th.

25,347. "Improvements relating to metallic conduit systems for electric cables and the like." W. T. Gray. November 25th.

25,389. "Improvements in and relating to electric lamps for vehicles." E. Aron. November 25th.

25,397. "Improvements in and pertaining to electric lamp-holders, especially switch lamp-holders." R. M. Botton. November 25th.

25,428. "Incandescent arc light." R. D. Cody. November 25th. (Complete.)

25,443. "Process for the avoidance of hollow spaces in the production of incandescence filaments or electric incandescence lamps from colloidal filaments." H. Kuzel. (Date applied for under Sec. 91 of the Act, October 15th, 1908, being date of application in Germany.) November 25th. (Complete.)

25,444. "Electric incandescence lamp with metallic incandescence loops." H. Kuzel. (Date applied for under Sec. 91 of the Act, October 26th, 1907, being date of application in Germany.) November 25th. (Complete.)

25,446. "Improvements in and relating to inter-communication telephonic systems." G. Burney (formerly known as I. B. Birnbaum), H. G. White and Brinkmann. (Application for Patent of Addition to No. 21,995, 1904.) November 25th.

25,453. "Improved construction of electric switch." G. Marky. November 25th.

25,461. "Improvements in and connected with the fixing of electric fittings, such as switches, ceiling roses, and the like." J. J. Rawlings, H. W. Handcock, and A. H. Dykes. November 25th.

25,465. "Improvements in and relating to alternating-current dynamo-electric machines." British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) November 25th.

25,478. "Improvements in and relating to secondary batteries." Van Raden and Co., Ltd., and M. Metz. November 26th.

25,485. "Improvements in and relating to electrically-heated apparatus." R. K. Hearn. November 26th.

25,508. "Improvements in or relating to incandescent lights and arrangements therefor." G. J. Epstein. November 26th.

25,537. "Improved means for starting and regulating compensated electric repulsion motors." Allmanna Svenska Elektriska Aktiebolaget. (Date applied for under Sec. 91 of the Act, November 27th, 1907, being date of application in Sweden.) November 26th. (Complete.)

25,547. "Improvements in and relating to magneto-ignition apparatus." The Firm Robert Bosch. (Date applied for under Sec. 91 of the Act, November 6th, 1908, being date of application in Germany.) November 26th. (Complete.)

25,556. "Improvements in and relating to the regulation of the power factor in systems of alternating electric current distribution." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 26th.

25,557. "Improvements in the manufacture of coherent bodies of refractory material suitable for use as glow bodies or filaments for incandescent electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 26th. (Complete.)

25,558. "Improvements in and relating to incandescent electric lamps." British Thomson-Houston Co., Ltd., J. Gray and T. E. Robertson. (Application for Patent of Addition to No. 11,460, 1908.) November 26th.

25,577. "Electric dial movement." W. S. Stelljes. November 27th.

25,586. "Improvements in electric cranes." J. Marshall, J. Fleming and R. S. Anderson. November 27th.

25,600. "Improvements in electric arc lamps." The Jandus Arc Lamp and Electric Co., Ltd., and A. D. Jones. November 27th.

25,613. "Improved means for locking incandescent electric lamp-head within their holders." G. W. D. Scott. November 27th.

25,631. "Improvements in and relating to heating apparatus." J. S Highfield. November 27th.

25,632. "Improvements in and relating to cooking apparatus and the like." J. S. Highfield. November 27th.

25,638. "Improvements in and relating to electric arc lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 27th.

25,655. "Improvements in instruments for indicating leakage of electricity." J. W. Manley and A. E. Stove. November 27th.

25,707. "New or improved material, chiefly for insulating, proofing, and like purposes." A. W. Weller. November 28th.

25,720. "Improvements in metal or metallic-filament lamps." T. A. Lake. November 28th.

25,721. "Improvements in controllers for electric motors." A. West November 28th.

25,742. "Improvements relating to the production of coherent conductors of refractory material suitable for incandescent electric lamps and for other purposes." British Thomson-Houston Co., Ltd., and J. Gray. November 28th.

25,755. "Improved automatic cut-in and cut-out devices for electric circuits." E. Dewhurst and A. A. S. Roscoe. November 28th.

25,758. "Improved trolley head for electric cars." C. S. Bayley. November 28th.

25,761. "Improvements in devices for converting into heat the energy of a monophase or polyphase alternate current circuit." A. Ponzini. November 28th. (Complete.)

25,763. "Improvements in or relating to electrical devices suitable for use as or in connection with switches, circuit makers and breakers, recorders, and for other purposes." W. B. Thorpe and Thorpe-Meter Syndicate, Ltd. November 28th.